THE MECHANICS' MAGAZINE, MUSEUM, Register, Journal, AND GAZETTE,

JULY 6TH.—DECEMBER 28TH, 1844.

EDITED BY J. C. ROBERTSON.

VOL. XLI.

"To apply to domestic convenience the improvements which have been made in science, and to introduce into general practicé such mechanical inventions as are of decided utility. * * * It is thus, that we may most effectually perform what the idolised sophists of antiquity but verbally professed—to bring down philosophy from the heavens, and to make her an inhabitant of the earth."

DR. YOUNG.

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GLADSTONE'S PATENT IRON CUTTING MACHINE.

Fig. 1.

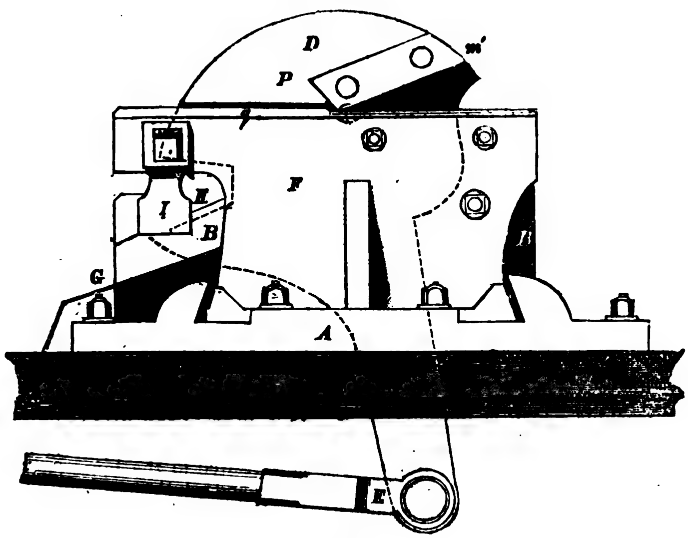
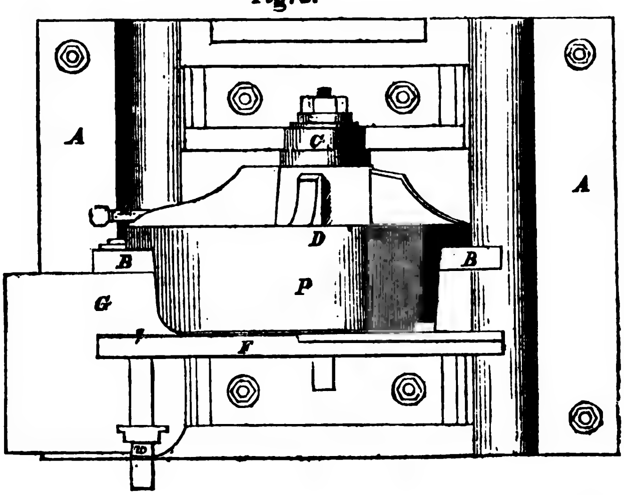


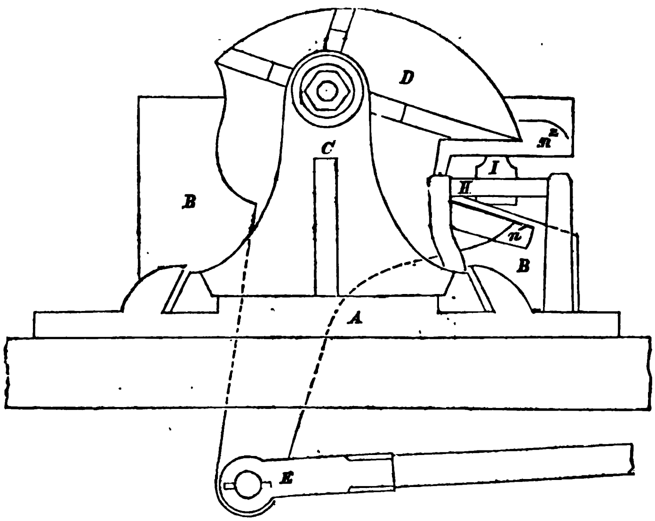
Fig. 6.



GLADSTONE'S PATENT IRON CUTTING OR SHEARING MACHINE.

[Patentee, Thomas Murray Gladstone, of Swan Garden Iron Works, Wolverhampton, Iron Master. Patent dated December 28, 1843; Specification enrolled, May 28, 1844.]

Fig. 2.



THE machine which is the subject of this patent is intended more particularly for the cutting or shearing of scrap iron; but it may also be employed with great advantage in all cases where metals have to be divided or pared by clipping. It is remarkably simple in its construction, easy to work, and of great power.

Figure 1 represents a front elevation of the machine; figure 2, a back elevation of the same; figures 3 and 4, two end views; and fig. 6, a plan. A is the bed plate; B is a main standard for the support of the axis of the shear blade, which is cast of the same piece with the bed plate. C is a back standard for the like purpose, which is in a separate piece from the bed plate, but dovetailed into, and screwed down upon it. D is the shear blade which turns on an axis supported by the two standards, B and C; the heft or arm of the blade passing down through an orifice in the bed plate to the crank E, which connects it to the moving power. F is a cutting standard placed a little way in advance of the main standard B, and dovetailed into, and screwed down to the bed plate in the same manner as the back standard C. The shear blade has two steel knife edges m^1 and n^1 screwed to it, in front and behind; the former of which works against a similar knife-edge m^2, screwed to the inner face of the cutting standard F, and the latter against a similar knife-edge n^2, screwed to the inner face of the main standard B. The sheet of iron, or other metal, is first passed under the cutting edges m^1 and m^2, and moved along the top of the standard F, as the cutting proceeds; the scrap, instead of curling up as usual, is kept by the projecting piece P of the shear blade quite flat, and when cut off it falls down through the space between the standards F and B, on to the delivery plate G. A thin strip of metal, q, which is screwed to the inner face of the standard F, behind the knife-edge m^2, and raised a very little way above the top of that standard, serves to keep the scrap, during the process of cutting, separate from the sheet of metal from which it is detached. The scrap is then (if required) passed crosswise under the cutting edges n^1 and n^2, in order to divide it into given lengths. H is a roller guide supported on two uprights, on which the scrap is rested, as it is about to be passed under the knife edges n^1 and n^2. And I is a movable stop, by which the lengths into

Fig. 3.

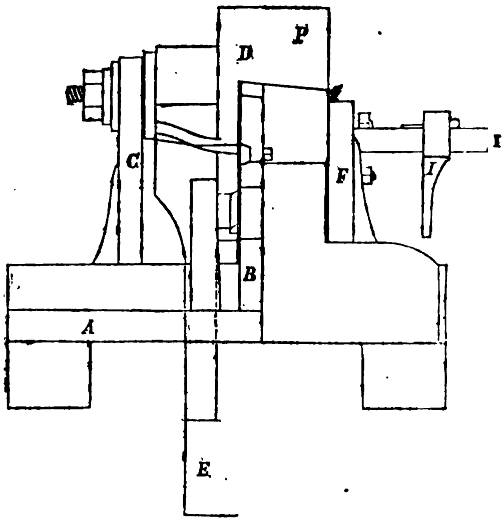
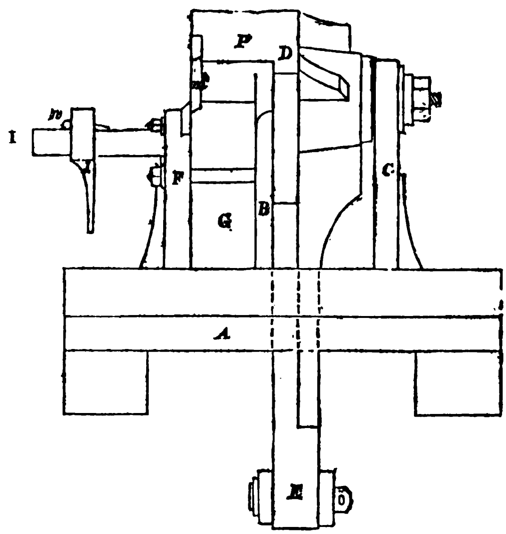


Fig. 4.



which the scrap is to be cut are determined; this stop fitting by an eye on a bar projecting from the front of the standard F, and being fixed at any part of that bar by the wedge-pin *w*, and the scrap being pushed forward to it when passed under the cutting edges n^1 and n^2.

The machine is represented in the engravings as being worked from below, but it may be readily modified, so as to be equally well worked from above, or from either end.

Since the appearance of this highly ingenious gentleman's specification, the writer has taken some little pains to hunt out whatever literary information is to be had upon the subject of *bronzes*, and has been surprised to find that little or nothing is to be found in books upon the subject. The writer has analysed a specimen of rich copper-coloured bronze powder said to be of French manufacture, and he finds it is merely composed of copper and zink, alloyed and coloured by cinnabar in a state of extremely fine division. Some vegetable colouring material (lake, probably,) is also present. This bronze powder, therefore, seems to be only Dutch gold, powdered and coloured.

Before Bessemer's specification had been published, the writer had also analysed his preparation, and found it to consist of

Copper	77·50
Zink	21·91
Lead	0·19
Tin	Traces.
Iron	0·21
	99·81
Loss	0·19
	100·

The amount of iron present, which then surprised him, is now seen obviously enough to be derived from his mode of grinding the metals on steel surfaces.

The probable working proportion of the alloy is most likely 70 copper and 30 zink, the difference being volatilized (of the latter) in the fusion. The nearest atomic alloy to this is that ($3\ Cu + Zn$) of 3 atoms of copper, and 1 of zink, which is by weight 74·58 copper, and 25·42 zink. This is the alloy of common rolled sheet brass.

In the proceedings of the Royal Irish Academy for last year will be found a paper, by Mr. R. Mallet, of Dublin, describing the proportions of brass found in a very unusual state of aggregation, viz., ground under the brass bearing of a heavy shaft into an impalpable powder, precisely similar to Bessemer's, and afterwards aggregated, and become perfectly hard, coherent, and capable of being filed with metallic lustre, *but having a jet black fracture;* the aggregation having been produced merely by great pressure, and at, or a little above, the temperature of the atmosphere.

In fact there are few persons who must not have remarked the extreme state of division in which the metal of shafts, bearings, and wheels are occasionally abraded in contact with oil. The writer possesses cast iron thus levigated from a pair of mitre wheels, as fine, unctuous, and soft, as black lead; and where power is cheap, it seems possible that a substitute for plumbago might thus be formed from cast iron, of the softer and more carbonaceous sorts, to advantage. The Styrian irons and Scotch ones, which are so soft, and rich in carbon, would answer best.

Bessemer's gold paint, owing to its extreme state of division, possesses also some remarkable physical properties. Thus, it is *apparently* perfectly infusible by the blow-pipe or charcoal; the fact being that, while really in fusion, its minute particles have not sufficient mutual attraction to cause them to cohere, and form a fluid globule. They will not even cohere, with the aid of a flux, such as borax; but if the red-hot mass, which has been thus caused just to stick together, be suddenly dropped into a steel mortar, and struck while hot, (in the same way as Doctor Wollaston caused his platina powder to weld together,) it coheres, and now breaks with a distinct brassy fracture; and on reheating, at once fuses into a fluid globule of brass.

There is no doubt but that, by severe pressure, and a gentle heat, this fine powder could be caused to aggregate and weld together, like the metal described by Mr. R. Mallet, and thus afford proof that the *welding* property is not an exclusive one attached to iron, and doubtfully to platina; but that it belongs to all bodies that pass through an intermediate state of softness, of pastiness, between the solid and the fuzed conditions, and that its only essential other conditions are, pressure, and the mutual presentation of the particles to each other free from oxidation. This latter obtains in iron; though so oxidable a metal, in virtue of the great affinity of its oxides for silica, with which they form a fusible coating that protects the iron; and jet squeezes out from between the surfaces presented at the scarph.

But to return. The merit of Mr. Bessemer's patent gold alone can consist in the cheapness with which he can afford it; for as to the mode of using it in a fluid paint, the same may be done with

any common bronze powder; but the fatal objection to the extended use of this material, either for in-door or exposed work, is that which equally affects the bronze powder, viz., that both are liable to the most complete and rapid deterioration of colour, or even total destruction of appearance, by the reaction of those foreign bodies which the air of cities and lighted or crowded buildings contain in abundance. Thus the writer finds Bessemer's gold is discoloured instantly by sulphuretted hydrogen or by ammonia, and rapidly by these bodies existing in common coal gas.

No external varnish seems to be capable of arresting the progress of these changes, which depend upon chemical affinities of great force, and in constant action.

The varnish sold with the gold paint appears to be nothing more than fine spirit of turpentine mixed with a little varnish or gold size. Turpentine varnish, diluted with spirit of turpentine, appears to do just as well. R. M.

June 28, 1844.

ON THE APPLICATION OF SUM AND DIFFERENCE LOGARITHM TABLES. PART III.

Sir,—It is not in detached examples, such as those given in my last paper, that the advantages attendant upon the employment of Matthiessen's Table chiefly appear. These are more fully felt in lengthened and continuous operations, such as are required in the construction of tables of various kinds. I am now to show the application of the Table in question to such purposes.

The first example I shall take is the calculation of a table of the *mean duration*, or as it is more commonly called, though with little propriety, the *expectation* of life. By the mean duration of life, at a given age, and according to a given table of mortality, is meant the average number of years that each individual at that age will enjoy, provided that the deaths take place as indicated in the given table. The definition suggests at once a method of finding the mean duration at any age. It is to add together the tabular number of the living at each age above the given age, and to divide this sum by the tabular number of living at the given age, adding 0·5 to the result, since each individual may be supposed to live on an average half a year in the year in which he dies. But this would be a tedious process if a whole table had to be constructed, and therefore recourse is had to a method by which the mean duration at each age is deduced from that at the age one year older; and so the table is constructed by a series of dependent and continuous operations.

Let x denote any age in the table of mortality made use of, and $e(x)$ the mean duration of life at that age. Then will $e(x+1)$ denote the mean duration at the age $x+1$, and the following relation will subsist:—

$$e(x)-\tfrac{1}{2}=p(x)[e(x+1)+\tfrac{1}{2}],$$

where $p(x)$ denotes the probability that a life now aged x will survive a year.* If we denote $e(x)-\frac{1}{2}$ by $e'(x)$, and consequently $e(x+1)-\frac{1}{2}$ by $e'(x+1)$, the expression will take the more convenient form of

$$e'(x)=p(x)[e'(x+1)+1].$$

The quantity $e(x)-\frac{1}{2}$, or $e'(x)$ is called the *curtate* mean duration of life; and the formula shows that, p being given for each age, if the curtate mean duration at any one age be known, that at each younger age may be successively deduced, and from these, by addition of 0·5, the complete mean durations. Now the curtate mean duration at the oldest tabular age is known, being equal to 0; and hence, when x is the next to the oldest age, we have for the curtate mean duration at this age,

$$e'(x)=p(x).$$

Consequently, setting out with this value, and proceeding as the formula indicates, we shall find in succession the required values for all the younger ages.

The operation is usually performed by logarithms, in the application of which the formula becomes,

$$\log e'(x)=\log p(x)+\log[e'(x+1)+1]$$

Here the applicability of Matthiessen's table becomes apparent, since we have in each operation to find the logarithm of $e'(x+1)+1$, in which $\log e'(x+1)$ is given, being the result of the previous operation.

I now give the calculation of the first few terms of the curtate mean duration according to the Carlisle Table of Mortality.

* It is the quotient arising from the division of the tabular number alive at the age $x+1$, by the tabular number alive at the age x.

Example 1.

Curtate Mean Duration of Life, Carlisle.

By col. C, Formulæ 14 and 8.

log $e'(103)$	5228 787	4771,213
,, $p(102)$	7781 513	
C	6020 441	
	160	
log $e'(102)$	9030 901	0969,099
,, $p(101)$	8538 720	
C	3521 770	
	55	
log $e'(101)$	1091 446	
,, $p(100)$	8908 555	
C	3589 969	
	251	
log $e'(100)$	2498 775	
,, $p(99)$	9128 498	
C	4436 479	
	496	
log $e'(99)$	3565 473	
,, $p(98)$	8952 647	
C	5148 770	
	329	
log $e'(98)$	4101 746	
,, $p(97)$	8908 555	
C	5527 884	
	537	
log $e'(97)$	4436 976	
,, $p(96)$	8935 447	
C	5771 647	
	717	
log $e'(96)$	4707 811	
,, $p(95)$	8846 065	
C	5972 530	
	606	
log $e'(95)$	4819 201	

By col. B, Formulæ 13 and 7.

log $e'(103)$	5228 787	4772
,, $p(102)$	7781 513	
B	1249 191	
	197	
log $e'(102)$	9030 901	0970
,, $p(101)$	8538 720	
B	2552 325	
	400	
log $e'(101)$	1091 445	555
,, $p(100)$	8908 555	
B	2498 532	
	243	
log $e'(100)$	2498 775	225
,, $p(99)$	9128 498	
B	1938 119	
	81	
log $e'(99)$	3565 473	527
,, $p(98)$	8952 647	
B	1583 464	
	161	
log $e'(98)$	4101 745	255
,, $p(97)$	8908 555	
B	1426 604	
	71	
log $e'(97)$	4436 975	025
,, $p(96)$	8935 447	
B	1335 382	
	6	
log $e'(96)$	4707 810	190
,, $p(95)$	8846 065	
B	1265 277	
	48	
log $e'(95)$	4819 200	

I now explain the two operations, taking first that by col. C. The oldest age in the table is 104; the value with which we set out, therefore, is log $e'(103)$, and this, as we have just said, is equal to log $p(103)$.* Log $p(103)$ therefore is first set down, and called log $e'(103)$. Now, to find log $e'(102)$. By the formula this will be equal to

$$\log p(102) + \log[e'(103) + 1].$$

Set down, therefore, log $p(102)$, and find log$[e'(103)+1]$ by Matthiessen's table. For this purpose we observe that $e'(103)$ is less than unity, since the index of its logarithm is -1;† and referring to the table in last paper, we find formula 14 to be the one adapted to our purpose. By that formula the argument for col. A will be colog $e'(103)$, that is, the arithmetical complement of log $e'(103)$. This, therefore, is set down to the right of log $e'(103)$. Col. A being now entered with the first four figures, viz., 0·4771, the C corresponding, viz., ·6020441, is set down, and under it 160, being the pro. parts for 213. The sum of these four lines is log $e'(102)$.

The operation for log $e'(101)$ is precisely analogous to that just described, since $e'(102)$ is also less than unity. But $e'(101)$ is greater than unity, as appears by the decrease which has taken

* The values of log p are taken from Mr. Milne's Treatise on Annuities, Table 18, pp. 592, 593. They are also to be found in Mr. Jones's Work, Table 25, p. 551.

† None of the indices are set down. The series to be found proceeds by such small and regular gradations that a knowledge of the index of the first term is all that is necessary.

place in the decimal part of its logarithm. For log $e'(100)$, therefore, and all the subsequent terms, formula 8 must be used, and the operation is so simple as hardly to need explanation. The argument for A is 0·1091, the C corresponding is ·3589969, and the pro. parts for 446 are 251. These being added to log $p(100)$, give log $e'(100)$, and so on for the remaining terms.

I have now to describe the process by col. B. We set out, of course, with the same value as before; and the formula made use of for the first two terms is formula 13. The argument for A is colog $e'(103) = 0\text{·}4771{,}213$. That the correction for the last three figures may be additive, we take out the B corresponding to 0·4772, and the pro. parts for 1000 − 213, or 787 (see first paper). A little consideration shows that this is the same thing as using for the argument the arithmetical complement of the *first four figures* of the given logarithm, *considering them as a distinct logarithm*, whereby the requisite increase is given to the 4th place, and taking the pro. parts corresponding to the last three figures of the given logarithm. This considerably facilitates the operation.

In consequence of log $e'(101)$ being greater than unity, formula 7 must be used for log $e'(100)$, and all the remaining terms. The argument for A, therefore, is the result last found. Accordingly, col. A being entered with the first four figures of that result, with the addition of a unit to the last figure, and the corresponding B taken out, with the pro. parts for the complement to 1000 of the last three figures; these two numbers added to the last result, and the appropriate log p, give a new result. Thus, for log $e'(100)$ enter A with 0·1092, take out B = ·2498532, and 243, the pro. parts for (1000 − 445 =)555. These being added to log $e'(101)$ and log $p(100)$, give log $e'(100)$.

These operations will be much simplified if all the logarithms of p be at the outset written down in their places, which, with the exception of the first two, which immediately follow each other, will be on every fourth line; and this will be materially facilitated if paper ruled both horizontally and vertically be used.* The spaces between the fourth and fifth figures of the logarithms aid distinctness, by separating the argument part from that for which pro. parts have to be taken.

We see that the results of the two methods in no case differ from each other by more than a unit in the last place; and since the methods are quite independent of each other, it is a legitimate inference (in this case consistent with fact) that none of the results differ by more than that quantity from the absolute truth. The corresponding numbers may therefore be taken out to seven places, if so many are thought requisite; and 0·5 being added to each, the complete mean durations will be obtained.

I give one other example. The present value of an annuity upon a life at any age is derived from that upon a life one year older by the following logarithmic formula:—

$$\log a(x) = \log v\,p(x) + \log[a(x+1)+1],$$

where $a(x)$ and $a(x+1)$ denote respectively the present values of annuities upon lives aged x and $x+1$ years, v the present value of £1 due in a year, and $p(x)$, as before, the probability that a life aged x will live a year. The value of an annuity upon the oldest tabular age is known, being = 0. If, therefore, x be the next younger age, the value of an annuity upon a life of this age will be given by the formula, thus:—

$$\log a(x) = \log v\,p(x) + \log(0+1) = \log v\,p(x), \text{ since } \log 1 = 0.$$

Here, therefore, as in last example, by commencing at the next to the oldest age, we find the values at all the younger ages in succession. And, in fact, the formulæ in the two examples being the same, except that here log $v\,p(x)$ takes the place of log $p(x)$ in the other, the operations are so entirely analogous as to need no farther explanation. In the example the rate of interest assumed is 3 per cent., so that

$$\log v = \text{colog } 1\text{·}03 = \bar{1}\text{·}9871628.$$

* The Editor can certify from an inspection of the MS. how effectually this simple contrivance answers the purpose.

Example 2.

Present Values of Annuities.—Carlisle, 3 per cent.

By Col. C, Formulæ 14 and 8.

log $a(103)$	5100 415	4899,585
,, $vp(102)$	7653 141	
C	6116 791	
	442	
log $a(102)$	8870 789	1129,211
,, $vp(101)$	8410 348	
C	3611 384	
	119	
log $a(101)$	0892 640	
,, $vp(100)$	8780 183	
C	3479 161	
	353	
log $a(100)$	2259 697	
,, $vp(99)$	9000 126	
C	4285 052	
	436	
log $a(99)$	3285 614	
,, $vp(98)$	8824 275	
C	4956 263	
	418	
log $a(98)$	3780 956	
,, $vp(97)$	8780 183	
C	5299 192	
	673	
log $a(97)$	4080 048	
,, $vp(96)$	8807 075	
C	5512 775	
	35	
log $a(96)$	4319 885	
,, $vp(95)$	8717 693	
C	5685 931	
	646	
log $a(95)$	4404 270	

By col. B, Formulæ 13 and 7.

log $a(103)$	5100 415	4900
,, $vp(102)$	7653 141	
B	1217 547	
	100	
log $a(102)$	8870 788	1130
,, $vp(101)$	8410 348	
B	2481 949	
	343	
log $a(101)$	0892 640	360
,, $vp(100)$	8780 183	
B	2586 712	
	162	
log $a(100)$	2259 697	303
,, $vp(99)$	9000 126	
B	2025 679	
	113	
log $a(99)$	3285 615	385
,, $vp(98)$	8824 275	
B	1670 943	
	124	
log $a(98)$	3780 957	043
,, $vp(97)$	8780 183	
B	1518 897	
	13	
log $a(97)$	4080 050	950
,, $vp(96)$	8807 075	
B	1432 494	
	266	
log $a(96)$	4319 885	115
,, $vp(95)$	8717 693	
B	1366 661	
	31	
log $a(95)$	4404 270	

In a concluding paper I shall give an example of the application of the more general formulæ 1 and 2, and also offer some observations on the comparative facilities of the methods by Matthiessen's table, and that by the common tables.

I am, Sir,

Yours respectfully,

G.

Hermes-street, Pentonville,
June 19, 1844.

Note by Mr. Woollgar.

The greatly increased choice which we now have of Tables of Mortality, must often render it desirable to have the value of an annuity upon a given life or lives, and at a given rate of interest, when there are no printed tables to supply the desideratum. By the table now under explanation the whole series of values may be computed in logarithms from the extreme down to the given age, without taking out any natural numbers, except the required final result. Add to this that the means of readily applying this method to cases involving two or more lives, may be secured by providing a set of circular pasteboards, having the successive values of $p(x)$ inscribed radially round the circumference of each, with the intermediate portions of pasteboard cut away; so that two or more of these pasteboards, being centrally superimposed according to the given differences of age, and the proper value of v being applied on the lower edge of a card, the whole series of logarithm necessary to be employed in conjunction with Matthiessen's Table is obtainable with the utmost ease.

We thought the days were long gone bye when the manufacturers of books (we do not mean *authors*), in order to give a factitious importance to their wares, were in the practice of ushering them into the world under such imposing titles as "By a Learned Society;" "By a Society of Wits;" "By a Select Body of Divines;" "By a Philosophical Club," &c. It was always of a low order of practices on popular credulity, and suited only to an extremely low state of popular knowledge. In times when there were many who imagined that everything they saw in print, must needs be true because it was in print, it could be no difficult matter to make many believe also, that clubs club sentences, and societies write books. But how many are there now-a-days whom such a title-page as the one before us will deceive? A Society may superintend the production of works by individuals—and such Societies of Superintendence there are; but Societies themselves do not write. So also, a journal or magazine may without impropriety be said to be by a Society or Club, for it is of the essence of such undertakings to depend on the contributions of numbers; but a dissertation, an essay, a "Treatise" by a Society or "Club" is an absurdity—an offence against truth and the intelligence of the age, for which the best apology that can be offered is, that it is committed at a time when it can mislead no one.

Where then is the harm? The harm is this, that the assumption of a corporate character for the nonce has begot airs of pretence in the individual assuming it, which as plain John Brown or James White he would have been probably ashamed of, and which in proportion to the distrust or disgust which they are calculated to create, must more or less impair his chances of usefulness. Everything is in the *ex cathedra* tone—to be believed less because of the reason there is in it, than because of the collective knowledge and wisdom from which, we are to suppose, it emanates. Authorities are never given, as if "we of the quorum" were an authority above all authorities, or if quoted, quoted at random. Instead of the plain matter of fact style so essential to the proper investigation of a scientific subject, we have the flippant verbiage of a would-be wit, whose whole stock in trade consists of affectation and conceit. Whatever, in short, the matter of this Treatise may be, nothing can possibly be worse than the manner of it; and for that manner we hold the "Club" fiction to be mainly responsible.

We must not, however, forget to notice one hypothesis, which would at once reconcile the title of this work to strict truth, and also account somewhat for the manner of it. A class of artizans there is, of whom it is proverbially said that it takes nine to make a man; and it may be that we are now sitting in judgment on a shopboard unit of this description. If this be indeed the fact, then we beg to be understood as retracting all we have said, and yielding with such grace as may become us, to the necessity of the case.

The "Treatise" begins with sneering at the necessity the writer *supposes* he is under of giving some "account of the doings of Savery, Papin, and the other patriarchs whose names figure in the history of steam invention." The "devices," he says "of these ancient worthies bear very little resemblance to the modern steam-engine, and can throw but little light upon its structure or operation." And to show how true this is, he observes in the very next page, when speaking of Hero's rotary engine, "The instrument is one of great ingenuity, *and has all the qualities of a true and efficient steam-engine*, EXCEPT ITS SIZE. This instrument is called the Æolipile, and is identical in all its material features with the engine lately constructed by Avery of America and Ruthven of Edinburgh, (which he considerately adds is) in this country. These engines are more expensive in steam than ordinary engines, and travel at an inconvenient speed; *but in other respects they are* QUITE AS EFFECTUAL, *and their construction* is extremely *simple and inexpensive.*" How correct this estimate of the efficiency of the Avery and Ruthven class of engines is, we need not say; but if we were to allow it to be correct, what must we think of the writer's consistency?

Hero's own description of his engine is professed to be given, and *within inverted commas*. The description, however, is not Hero's, but a loose and inaccurate paraphrase of it by some modern commentator or other, from whom the author has adopted it. We give below, in opposite columns, the description really given by Hero as rendered into Latin, in the Urbino edition of the "Spiritalia," 1575, in which the Greek original is closely followed, and our Clubbist's English version, that the reader may judge for himself.*

The *Spiritalia*, we are told, contains "a variety of devices for elevating liquids, and obtaining rotary motion by means of air and steam;" but the writer deems it sufficient to "enumerate those only in which it is beyond doubt steam was the agent." And the enumeration which follows includes but two devices, the well-known rotary engine already spoken of, and "a method of causing wine to flow from the hands of effigies set beside an altar, after the fire upon the altar has been lighted" (the description of which last is also a gross parody of the original.) The writer has evidently never seen the work the marrow of which (*quoad hoc*) he pretends to extract; all his knowledge of it must have been derived from some secondary and corrupt source. The *Spiritalia* contains descriptions of no less than thirteen different machines or instruments in which steam or heated air is the moving power; and at least seven of them are "beyond doubt" steam-engines. The real value of this remarkable work in its relation to the steam-engine has, in truth, been as little appreciated by writers on the subject generally as by the ill-informed compiler of the present "Treatise." It is always spoken of, as if the rotary engine described in it (called Hero's, though he nowhere pretends to have invented it,) were the only steam contrivance in it worth notice. But there is not much regarding either the principles of the steam-engine, or its mechanical elements, of which broad and vivid traces are not to be met with in this volume. We have, to begin with, a Treatise on Pneumatics, in which the venerable crotchet of Nature's abhorrence of a vacuum, is excellently handled, and views of the expansion and compression of fluids are propounded, as sound as any to be found in the best modern works of natural philosophy. We have then the principles laid down in the Treatise, illustrated by descriptions, of seventy-six of those mechanical wonders or mysteries with which the priests of Egypt were wont to delude their followers, (for Hero, like Moses, "was learned in all the wisdom of the Egyptians,") such as temples with self-opening gates; sacrificial altars with approving trumpeters or hissing dragons; self-playing organs; self-blowing furnaces; singing and dancing automata; ever-burning lamps without oil, &c. In the course of these descriptions we are shown *how liquids may be forced by the pressure of steam above their level—how solid weights may be raised and lowered by steam—how*

Hero's own.

"Sit lebes succensus, qui aqua habeat A, B, obstruatur que osculum cooperculo C, D, et una cum eo simul perferetur tubus inflexus E, F, G, cujus extremitas, G, ad concavam sphærulam, H, K, aptetur. Extremitate autem exdiametro opponetur cuo dax L, M, cooperculo, C, D, mixus, et sphæra duos tubulos inflexos habeat secundum diametrum simul cum ipsa perforatus qui vicissim inflectantur; sunt que inflexiones et rectos angulos.

"Continget igitur succenso lebeta vaporem per tubum, E, F, G, in spherem in eidentem extra cadere per tubos inflexos et spherem convertere, quem ad modum in animalibus choreas du certibus."

The "Artizan Club" Version.

"Let *a boiler be set on the fire*,* and *nearly filled with water*, and let its mouth be closed by a cover which is pierced by a bent tube whose extremity fits exactly into a hollow sphere. But at the opposite end of the diameter of the sphere let there be an *iron* axis *supported from the top* of the cover, and let the sphere have two bent pipes *at the ends of a diameter of the sphere perforated therewith and bent round in opposite directions*; and let the bends make right angles *and have the plane perpendicular to the axis*.

"Then will it follow that the boiler being heated, the vapour, rushing through the tubes into the sphere, will rush out through the reversed tubes, and whirl the sphere round on its axis."

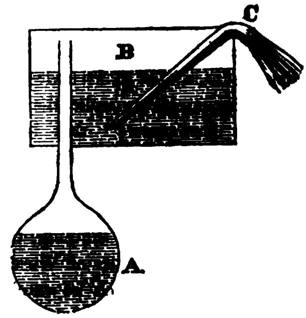
* The original says, *to be heated* (*succensus*) only, and in this, as in all the contrivances described by Hero, which were contrivances of the Egyptian priests for deceiving the people, the active agencies were carefully concealed. *Putting the kettle on the fire*, is rank modern.

bodies may be made to revolve by steam—and even how the pressure of steam may be augmented and regulated. The mechanical instruments, moreover, by which these purposes are effected, are precisely the same as those which figure most prominently in modern steam-engine machinery, as cylinders and pistons, (ignorantly said in the "Treatise" before us to have been "suggested" by Papin, some fifteen centuries later !) oscillating beams, parallel motions, weighted levers, spindle valves, &c. True it is that "the contrivances enumerated were mere mechanical toys, which, though not incapable of useful applications, were only employed to excite the wonder of the ignorant ;" but the physical facts, of an existing knowledge of which by the ancient Egyptians and Greeks they are incontestable proofs, are not on that account the less real, or less worthy of note.

From Hero, our "Treatise" writer makes a long stride to that very apocryphal personage, Blasco de Garay, who is said to have propelled a vessel by steam in the harbour of Barcelona, in 1543. The Spanish story on this head he adopts implicitly, as if there never had been, and never could be, any question about its authenticity. Now whatever may be his own impressions on the subject, he was bound in common justice and candour, to apprise the reader that the story is one of very modern resuscitation, if not invention, and that it has been utterly discredited by several writers, including no less distinguished a philosopher than M. Arago. For ourselves, we too are unbelievers.

Porta's apparatus for raising water, described in his "Spiritali," 1601, (a work so named after the "Spiritalia" of Hero,) and which Mr. Ainger, a very competent authority, regards as "extraordinary" for its near approximation to the modern lifting engine, is here regarded as a very poor affair; but the Marquis of Worcester's scheme for the same purpose, 1653, is extolled as being "the first feasible one for raising water by steam that history records," and as having resulted in the actual erection of "a powerful and effective engine." We will show in a few words that both these engines—the slighted, as well as the extolled—are precisely the same in principle, and that what that principle is, the writer has very much misconceived.

The following is an engraving of Porta's engine:—



A is a boiler, with a long neck, which passes up through the bottom of a close cistern, B, to near the top. Both vessels contain water. A bent tube or syphon, C, is closely fitted into the top of the cistern B, and descends nearly to the bottom of it. Fire is to be applied to the boiler A, to evaporate the water within it, when the steam ascending into the upper part of the vessel B will press upon the cold water beneath, and force it up through the syphon in a continuous stream.

Now what is the Marquis of Worcester's plan? "It does not," he says, consist "in drawing or sucking upwards," that is, in raising by means of a vacuum; but "one vessel of water rarefied by fire," that is, expanded into steam, "*driveth up* forty of cold water; and a man that tends the work has but to turn two cocks, that one vessel of water being consumed, another begins to force and refill with cold water, and so successively; the fire being tended and kept constant, which the self-same person may likewise abundantly perform in the interim between the necessity of turning the said cocks." The Marquis, like Porta, has two vessels, one in which the steam is generated, and another containing the water to be raised by the force of the steam; and it is only by connecting them

together in the manner described by Porta that the effects he describes could possibly be worked out. Add to Porta's engine the two cocks of Worcester's, and you have the Worcester engine complete; or add to the Worcester the communicating neck and syphon of Porta, and you have the Porta engine complete. The two engines, in fact, are palpably identical.

Our "Treatise" writer's notion of the Worcester engine is, that "two boilers must have been indispensable to make the action of the engine continuous;" that is, that while one boiler was giving off its steam, another must have been getting ready to supply its place, and "so on successively." We hope to be excused for thinking, that it is fully as likely the Marquis of Worcester knew what the means which he employed were, as his present commentator. Had there been two boilers, there must have been two fires also, and three cocks instead of two to attend to; but the Marquis speaks distinctly of only one, or "*the* fire," and "two cocks." We must be allowed also to doubt whether, supposing the Marquis had experienced any difficulty in working his machine continuously, he would have had recourse to so rude and clumsy an arrangement as that here suggested. But where could be the difficulty? Can it be possible that the writer of the "Treatise" has never seen in modern practice a constant supply of steam kept up from a single boiler? If he has yet to be taught how this may be done, let him inspect the working of the *montjus* of any sugar manufactory, which is almost a literal copy of the Porta-Worcester engine, and he will learn all about it.

The claim set up by the French to the invention of the steam-engine on the strength of the plans of De Caus, 1623, and Papin, 1680, has been the subject of much well-deserved ridicule, and may be considered as definitively rejected by all the rest of the world. The present writer cannot be said to throw any new light upon it; but he handles it in a way which he would seem to expect must carry the victory of truth still further, and convince even the French themselves that they are in error!

"M. Arago and his followers have set the steam-engine down as a French invention, because Solomon de Caus first adopted the idea of steam as a motive force, and Papin suggested the application of the cylinder and piston. *It would be as reasonable, in our apprehension, to set down the battle of Waterloo as a French victory, because Napoleon adopted the idea of fighting it*; for the question in all such cases is, not who first adopted an ideal result, but who actually realized that result in practice."

What the French can have to say on the subject after this, we know not. The reasoning is such as really leaves nothing to be said, and the allusion to Waterloo is as clenching as it is delicate.

Savery, Newcomen, Smeaton, come next under review; but afford an opportunity for a mere repetition of facts and details common to almost every work which has been already written on the steam-engine.

Watt follows; but of his brilliant career we have in the Part of the "Treatise" now before us the commencement only. The writer acknowledges this to be a fit theme for the highest powers of eloquence, and gives us to understand that he could say something particularly fine upon it, if he chose; but for the reason which follows he reserves his strength:—

"We cannot trust ourselves to say anything upon a theme so attractive as Watt's genius at the present stage of our progress, as *we fear we should afterwards be unable to speak of anything else.*"

What it is to have a soul! (we would say *above buttons*, but that we have a lively apprehension of being personal.) So Watt-struck that if he but "touch the strain," he will ne'er be "well again." Alack-a-day!

It will not be expected that, after the proofs we have given of this writer's very imperfect knowledge of the subject matter of his work, and inability or disinclination to treat it as it ought to be treated, we can encourage our readers to hope for much good from his labours. We admit that there is ample room for a good practical work on the steam-engine; but if we may judge of the present "Treatise" from the specimen Part before us, it is not by this the want is destined to be supplied. The writer may

possibly come better out in future Parts; and if he does so, we shall not fail to do justice to whatever redeeming merits they may display.

FOREIGN SCIENCE.

The Crystalline and Amorphous States of Bodies.

Pelouze has published some very interesting remarks upon the difference in physical properties between the same substance in the crystalline, and in the amorphous states. These differences, he has shown, are often so great as to make the same chemical body physically isomeric.

Wöhler found a good while since, that a difference of fusibility existed in the same body, according as it was amorphous or crystallized. Pelouze finds that the amorphous oxide of mercury is decomposed and volatilized at a temperature in which the same body in crystals is scarcely altered, and he has found the same to be the case with binoxide of manganese in similar conditions, and with chalk and Iceland spar. A useful practical conclusion may be drawn from the latter fact, viz., that *crystallized* limestones are the least economical (*cæteris paribus*) to burn into lime, while the amorphous lime deposits, such as hard chalk, the Flintshire limestone, &c., are the most so.

Preparation of Peroxide of Uranium by Malaguti.

The oxide of uranium has of late years become an extensive article of commerce as a colouring material for porcelain painting. The peroxide, however, had not before been isolated: it is highly probable that it may afford new and valuable hints for this purpose of art.

Malaguti proposes the following mode of preparing it. A solution of the per nitrate of uranium is formed in alcohol (which must be highly rectified); this is evaporated by a moderate heat avoiding ebullition. When the fluid has been reduced to a certain point of concentration, it gets into a state of violent intestine motion. Nitrous ether, nitrous gas, aldehyde, and formic acid, are disengaged, and there remains a spongy orange yellow mass, upon which water is to be poured.

This separates it into two portions; the one undecomposed nitrate of uranium, which may of course be used again, and the other insoluble, of a beautiful pale yellow, which is to be washed with water until all acid reaction of the washing water is imperceptible. There remains pure, the peroxide of uranium, combined with an atom of water, whose formula is $U_2 \ O_3 \ + \ H \ O$.

Fossil Manures.

Every one who has read Leibig's delightful Letters upon Chemistry will recollect that the little volume concludes with a remarkable flourish respecting the existence of inexhaustible mines of fossil manure in the beds of coprolites, existing in many of the calcareous formations of England, the author in the enthusiasm of the thought, reflecting on the singular providence which laid up fossil fuel in our coal beds for our manufactures, and fossil manures in the beds of coprolites for the farmer.

Few, however, who have read this are perhaps aware of the real state of the case, or of the odd circumstances which led Leibig to make for once a palpable misstatement.

Coprolite is the name given by the geologists (who delight in hard words, and where a vacuity in their knowledge occurs, generally conceal the void by a jaw-breaker,) to the fossil dung of various fossil animals of the reptile kind, saurians, &c. As the excrements of these animals must have been very analogous to those of serpents, &c., in our own day, which are known to contain large quantities of phosphate of lime, uric acid, &c., it was not unreasonable to suppose that the fossil excrements might contain the same; accordingly, it is said that when Leibig was last in England, Doctor Buckland pointed out to him the great bed of coprolites, near Bristol, where, as well as at Lyme Regis, &c., &c., they are found in considerable abundance. Leibig asked, how much phosphoric acid they were known to contain, and the Doctor told him some very large quota indeed. Leibig, now *big* with the treasured thought, wrote off to Sir Robert Peel, that he had discovered the treasure that was to enrich

English agriculture, at once, and for evermore; put it beyond the need of guano, and settle the sliding scale, and all such questions, finally.

The Premier, who likes the practical, wrote to his standing counsel in science, who happens to be the same learned Doctor Buckland, informing him of Leibig's views, and evidently full of the idea of opening *dung quarries* all over the country. The Doctor now for the first time began to look about him seriously (and not in his usual off-hand style) as to how much manuring material (phosphates) these same fossil dung beds contained, when lo, the unpleasant fact appeared, that he had led Leibig astray, that the amount of phosphates present was very small as compared with what he had told Leibig, and that for this and other reasons the dung quarry speculation, however it might be unpleasant in his own and some other persons' nostrils, was never likely in any other way to resemble manure. And so he was fain to tell Sir Robert; but, meanwhile, Leibig's book made its appearance with the original flourish of coprolites in it, and *on dit*, that Leibig is much obliged, and bears kindly in remembrance the value and flippancy of his cicerone's information, which thus enabled him to jump at a conclusion before "Pharaoh and all the Egyptians."

Seriously—if the story as thus told, and we have it from high authority, is a fact—Leibig, whose accuracy is so habitual, and who, therefore, was the more likely to repose implicitly upon the statements of Dr. Buckland, as men expect to find like habits of mind in others with their own, has strong ground of complaint at the attitude in which he has been for once placed. The matter of fossil manures has, however, excited a great deal of attention on the Continent, and had done so before the publication of Leibig's letters.

Girardin and Preisser read, in 1842 or 1843, a most important memoir on the subject, to the Royal Academy of Sciences, in which they give the results of analyses of great numbers of ancient bones, fossil remains, animal earth from grave-yards, &c. The whole paper is of importance to the agricultural chemist.

Ancient human bones from Gallo-Roman tombs near Caen, Normandy, contained

	Fontenoy	Blainville
Cellular tissue (gelatine)	9·95	9·12
Sub-phosphate lime	80·59	80·01
Phosphate magnesia	1·22	1·91
Carbonate lime	8·24	8·96
	100·00	100·00

The sort of calcareous cement which enveloped these ancient bones, and filled the medullary cavities, was found to have the following composition:—

Carbonate lime	83·75
Siliceous sand	14·74
Phosphate lime / Phosphate magnesia	1·51
	100·00

The small portion of phosphates here, the authors trace to the decay of the muscles that surrounded the bones.

The two following analyses are of bones from a Roman tomb at Lillebonne, and from the bone-cave of Mialet (Sard.)

	Lillebonne.	Mialet.
Organic matter (gelatine)	0·81	10·25
Sub-phosphate lime	76·38	78·12
Carbonate lime	10·13	8·82
Phosphate magnesia	8·20	2·81
Phosphate iron	2·58	,,
Silica	1·90	traces
	100·00	100·00

A remarkable bone from the Roman tomb at Rouen was analyzed, and found to contain no less than 3·31 per cent. of carbonate of copper, of unknown origin: it was coloured green throughout, like tourquois.

The vertebræ of a Plesiosaurus, from the Oxford clay; heavy, nearly black, looking like an ore of iron, and very hard and difficult to break; and of the head of an Ichthyosaurus, from the Jurassic limestone of Caen; had the following composition:—

	Oxford.	Caen.
Hygroscopic water	2·20	0·60
Organic matter (gelatine)	4·80	7·07
Sub-phosphate lime	54·20	70·11
Phosphate magnesia	4·61	1·45
Phosphate iron	6·40	,,
Carbonate lime	10·17	17·12
Fluoride calcium	2·11	1·65
Silica	9·21	2·00
Alumina	6·30	,,
	100·00	100·00

Some other bones, from Valonges, contained no trace of gelatine at all; the

marrow was wholly replaced by a mass of silica and carbonate lime. The following analysis of the scales of the Teleosaurus, from the Jurassic limestone, and of the modern crocodile of our day, from Senegal, are interesting.

	Teleosaurus.	Crocodile.
Organic matter	1·50	1·15
Sub-phosphate lime	72·36	70·92
Phosphate magnesia	1·46	1·20
Phosphate soda	2·91	3·25
Carbonate lime	11·27	10·27
Silica	10·50	13·21
	100·00	100·00

The authors found a coprolite from Lyme Regis contained much sub-phosphate lime, but they did not determine how much. They add, that these bodies *very much* in composition. They found, also, that they contained urate of lime and ammonia.

The following is their analysis of the animal earth, or mummyfied flesh, as they call it, produced by the cadavres interred in the church of St. Peter, at Caen (Normandy): its appearance is like certain friable red turfs.

The matter which they call azulmic acid, had the composition,

Carbon	50·23
Hydrogen	1·68
Nitrogen	47·90
	99·81

represented by the formula $C_5 Az_2 H$:

Hygrometric water	10·40
Azulmic acid	35·17
Azulmate ammonia, Carbonate potass, Chloride potassium, ——— sodium, Sulphate potass, Phosphate soda	0·72
Ammoniacal soap, Resinous matter	12·71
Sub-phosphate lime, Carbonate lime, Carbonate lead, Sand	39·00
	100·00

A sufficiently complex body. The carbonate of lead, it is to be presumed, comes from the old lead coffins.

A great number of other analyses are given, and some important deductions are drawn. The most valuable, however, is the following, which clearly shows that fossil bones will be nearly valueless as manure, unless, like the Apatite of Estramadura, which Doctor Daubeny went to explore, it be previously submitted to certain chemical operations; and it is more than questionable whether any processes can make them of service to the agriculturist.

The authors find that ancient human bones, as well as those of fossil animals, contain more sub-phosphate of lime than those of recent animals; but that, under conditions not understood, the *state* of this phosphate has become changed, so that the ordinary bone phosphate, consisting of eight atoms of lime, and three of phosphoric acid, has been converted, without loss or gain of its elements, into two new and much more stable phosphates; viz., the neutral and the sesquibasic phosphates of lime. The change may be shown by the following formula:—

$$(8\,CaO + 3\,P_2O_5) = (2\,CaO + P_2O_5) + 2\,(3\,CaO + P_2O_5)$$

The tendency of the sesquibasic phosphate to crystallize, probably induces this breaking up and re-arrangement of the elements of the phosphates; but it results, as Berzelius has observed, that the bone has become useless as manure; and the same, whenever it is tried, will probably be found to be the case with the coprolites, and all other fossil phosphates.

The crystals of the sesquibasic phosphate formed in these ancient bones, are identical in form with those of the mineral phosphorite. The insoluble metallic phosphates (iron and manganese) in the ancient bones seem to be formed by a slow double decomposition.

The coprolites are very analogous in composition to guano, and were they not so very hard, might possibly be used as a manure. The composition of the animal earth or mummyfied flesh, shows that the speculation of poor Loudon, just before his lamented death, of digging up our churchyards, or rather grave-yards, (that is, those of the poor, for the rich must not be desecrated,) every seven years, and making manure of them, was right in principle, although in fact it may be feared, a proposition *rather* before even our age; one in which, by a start, the agriculturists have got impressed with the notion, that they will be relieved to a great extent of the labour,

that is, the price of earning man's daily bread, by the inventions of the chemists, who while they have and can undoubtedly direct the principles of some important branches of agricultural operations to a certain extent, and this a valuable one, have beyond this excited hopes and raised expectations, which, however they may answer their own, and the statesman's present purpose, are almost certain only to end in the disappointment of both chemists and farmers. The latter would in this matter do well even now to consider Bacon's maxim,—"Stay awhile, that we may make an end the faster."

(To be continued.)

NOTES AND NOTICES.

The Wood-Paving Patents.—In the case of Stead v. Williams, in which the plaintiff obtained a verdict at the assizes at Liverpool, September 2, 1843; the Court of Common Pleas have ordered a new trial on the ground of misdirection by the judge who tried the case. On a full consideration of the subject, the Court expressed themselves of opinion that the view taken by the counsel for the defendants was substantially correct, and that the question for the jury ought to have been, "whether upon the whole there is evidence to show that the invention for which the patent was granted previously formed part of the stock of public information or not." We presume that this will put an end to further litigation on the subject, for the fact of the invention of wood paving having previously formed part of the stock of public information is beyond dispute. It was published (as mentioned by the Court) both in the Transactions of the Society of Arts and in the *Mechanics' Magazine* long before the date of Stead's patent. All this fully confirms what we stated at the time when the question was raised, namely, that Stead's patent does not extend to wood paving generally, but to certain peculiar forms only, "and that every form of wood-paving which is not an imitation and evasion of Mr. Stead's forms, is, equally with them, the subject of a good and valid patent."

The Smoke Nuisance Prevention Bill—has been shelved for the present Session. Mr. Mackinnon, who undertook the management of the Bill, by confining its operation in the first instance to steam-engine furnaces—with the vain hope of thus lessening the chances of opposition—gave the steam-engine interest so just a ground of resistance that success was impossible.

Royal Steam Navy.—Another first-class steam frigate, called the *Retribution*, has been just launched at Chatham. She is larger than the *Penelope* by 5 feet, but 3 inches less in breadth; and is to have engines, by Messrs. Maudslay and Co., of 800 horse-power, exceeding those of the *Penelope* by 150 h. p.

Safety Beacon for the Goodwin Sands.—It will be recollected that a safety beacon, the invention of Captain Bullock, R.N., was placed on the Goodwin Sands some years since, and still braves the storm. Another, constructed by Mr. James Walker, C.E., of larger dimensions, has just been placed on a different part of the sands. This beacon is an experiment, and, should it succeed, it is the intention of the Trinity Board that similar fixed erections shall supersede floating buoys. Mr. Walker's beacon consists of a strong iron column, about forty feet high, based on a circular platform of solid masonry, the latter being upwards of twenty feet in diameter. The foot of the pillar is bell-shaped, and tapers upwards to the extent of some six or eight feet. About the middle of the column there is a convenience resembling a vessel's top, surrounded with an iron railing, capable of receiving, we should say, half-a-dozen men; and on the summit is placed an iron basket, shaped like a balloon, which is also constructed to contain about a like number of persons, should they be enabled to reach it in the case of shipwreck. The column is tied down to the stone-work by iron stays, and on it are fixed steps, by which it may be ascended. The whole of the machine is incased in a huge timber vessel, resembling a brewer's vat, in which it was built, for the purpose of floating it to its station on the sands. The sides of this wooden building are constructed in such a way as to admit of their being removed on the beacon settling down in the sand. The bottom, on which the masonry rests, will, however, remain under the beacon.—*Daily Papers.*

Bronze.—The Chinese bronze copper in a very superior manner. This is the mode of the ancients, for urns and other little vases and ornamented goods:—After having rubbed the article with the ashes of coal and vinegar, in such a manner that the copper is very shining, they dry it in the sun, then they cover it entirely with the following composition: two mace of verdigris; two mace of mineral cinnabar; two mace of sal ammoniac; two mace of the beak and liver of duck; five mace of alum, well pounded, well mixed, and moistened sufficiently to make a paste, which may be spread. (The *mace* is the tenth part of a Chinese ounce.) When the article is thus prepared, it is passed through the fire, and washed when it is cold. It is covered a second time with this composition: it is then passed through the fire, and it is washed thus ten times. The small pieces thus bronzed, are of great beauty, and lose nothing by being exposed to open air and rain.—*Capt. Pidding's Chinese "Olio."*

New Safety Lamp.—At the last meeting of the Literary and Philosophical Society, Newcastle, Mr. Henry Smith, of that town, described a lamp invented by him, or, as it may rather be called, an improvement on Stephenson's lamp, still in part adhering to the principles of the Davy. By a careful consideration of the subject, Mr. Smith has come to the conclusion that more air is admitted in the Davy than is necessary to support combustion. Stephenson's lamp admits but a small quantity of air, and is thus easily put out by a change of position, or a current of air, and when the atmospheric air is deteriorated by the mixture of hydrogen, sufficient oxygen is not admitted, and the light is extinguished: it, therefore, shows when the air is impure, but so sensitively, that it is extinguished before any accident can occur. Mr. Smith's lamp resembles the Davy in the brass reservoir and top, and the same kind of wire gauze, but in addition, at the bottom of the wire gauze, there is a hollow metal beading, which constitutes an air chamber, opening into which, from the outside, is a series of holes, so apportioned that the flame cannot go out until the air becomes too vitiated for a man to breathe in it; inside the wire gauze is a glass cylinder, with a copper top, perforated with holes; the gauze fits close to the copper top, and is held fast by a screw, which also carries the glass. In this lamp it will be seen that the flame could not ignite the inflammable gas outside, without passing in a downward direction through the gause first, then the air chamber, and, lastly, through the perforated head. The miner cannot light his pipe at the flame, the danger of ignition from particles of fine coal-dust is avoided, and, should the glass be broken, the lamp is still a Davy lamp.

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Edited by J. C. Robertson, No. 166, Fleet-street.

MACDONALD'S INSTRUMENT FOR ENLARGING AND REDUCING PATTERNS AND DESIGNS.

Fig. 1.

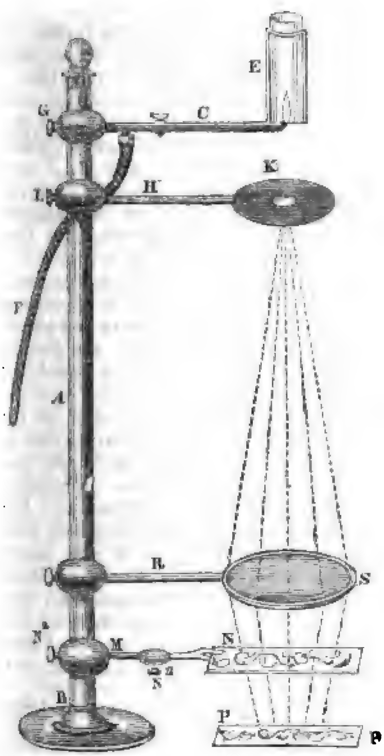
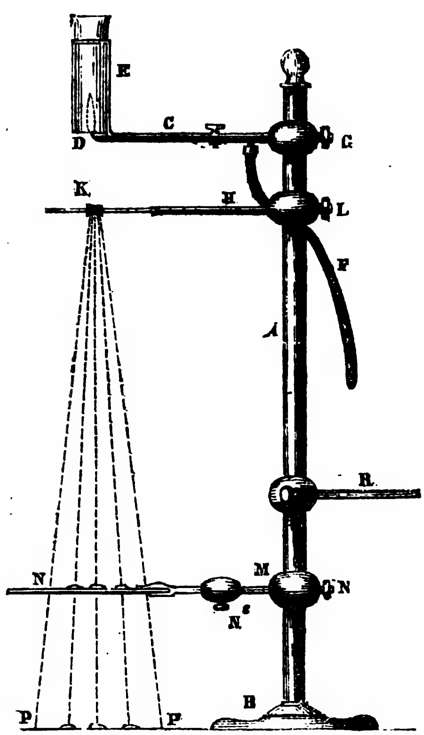


Fig. 2.



MACDONALD'S INSTRUMENT FOR ENLARGING AND REDUCING PATTERNS OR DESIGNS.

[Registered under the Act for Protection of Articles of Utility.—Thomas Macdonald, of Duke-street, Glasgow, Proprietor.]

A READIER means of enlarging and reducing drawings than is afforded by the pentagraph has been long an acknowledged desideratum. The present invention for the purpose is constructed on correct optical principles; and though its range of operation is limited, that range includes a vast number of obvious and useful applications.

Fig. 1 represents this instrument in the state in which it is when employed to enlarge a pattern or design; Fig. 2 the same when adjusted to produce copies on a reduced scale.

A is a pillar, four feet, more or less, high, with a broad basement, B. C, a hollow sliding arm, which terminates at its outer extremity in a gas-burner, D, (or other artificial light,) surrounded by a conical glass chimney, E. F is a flexible tube by which gas is supplied to the hollow arm C. G is a binding screw, by which the arm C, and of course the light, can be fixed at any height required. H is a second sliding arm, which supports at its outer extremity a concave lens K, and may also, by means of the binding screw (L) attached to it, be fixed at any required height. M is a third sliding arm, which terminates at its outer extremity in a strong clasp, in which is inserted a glass plate N, on which is drawn, in some opaque colour or colours, the pattern or design which is to be enlarged (the drawing having been made by superimposing the glass on the original pattern, and then tracing it out upon it). N^2 N^3 are two binding screws, one for securing the arm M, and the other the plate N in its place. P is a piece of card or paper, on which the pattern or design on the plate N is produced in shadow on an enlarged scale. R is a fourth sliding arm exactly similar to H, but carrying at its extremity a convex lens, S, by the interposition of which between the pattern plate N and the card or paper P, the rays of light are concentrated, and the copy in shadow produced of a smaller size than the original. When the pattern or design is to be enlarged, the arm R is turned round out of the way, as shown in fig. 2.

The pattern or design is enlarged, more or less, according to the nearness of the pattern plate N to the light; and in like manner the outline on the pattern plate is more or less diminished according as the convex glass S is raised or lowered.

The shadow of the pattern or design is also more or less foreshortened as the pattern glass N is turned more or less at an angle to the paper which the shadow is thrown down upon.

BREAKWATERS—SIR SAMUEL BENTHAM'S PLANS.

Sir,—The desire now so generally entertained of forming harbours of refuge on our coast, induces me to furnish for your influencing Magazine some particulars which may not be generally known, in regard to modes different from those in use, for constructing breakwaters, and more or less free from the objections urged against those of the usual construction, namely, the great expense and difficulty of forming them in places the most desirable, and the mischiefs they may occasion when executed.

The principal of these objections would be obviated by the adoption of any one of the three modes of constructing breakwaters devised by the late Sir Samuel Bentham in the year 1811, he then, being a Commissioner of the Navy, with the distinct duty of Civil Engineer of the Navy, to which office his former one of Inspector General of Naval Works had been changed. The modes in question were proposed by him officially in Minutes to the Navy Board; they have been twice printed by order of the House of Commons, first in the year 1812, again in the year 1842, and were also ordered to be laid on the table of the House of Lords the same session. I proceed to furnish you with extracts from these official papers.

In speaking of objections to a long, fixed breakwater, the Minute states that,

> "By opposing throughout its extent a complete interruption to the existing waterway," (of the river Tamar) "it would occasion such extensive eddies in the wake of the work, and such an increased action on the bottom and sides of the parts left open, as could not fail of forming shoals, more or less injurious, according to the nature of the soil, and other local circumstances.

"2nd. That the erecting one artificial rock of so great extent in the middle of the entrance of the harbour, and the projecting another from the side of it, over a space at present navigable for large ships even at low water, must be considered as contracting the entrance to a very large amount; that in the entrance channels the velocity of the tide would be very much increased.

"In the forming of my plans, attention has been paid to obviating these objections more or less completely. By one of my plans, a double row of cylindrical masses, built in my new mode, are designed to be deposited in the direction most suitable to a breakwater, in such a manner as to leave an interval between each two masses, about equal to their diameter, and that the masses of one row should be placed opposite the intervals in the other, so that while these two rows together form a complete obstacle to the direct course of the waves, the tide or current would be allowed to pass freely between them throughout the whole extent of the breakwater, as also boats, and even small vessels in moderate weather.

"According to another variety of this mode, a single row of masses, more in the form of the piers of a bridge, might be deposited at a greater distance, one from the other, and other masses of stone might be deposited upon them, so as to form a kind of bridge; but differing from ordinary bridges, inasmuch as that the arch between the piers rising *above* water, the bottom of the parts intermediate between the piers would be kept sufficiently *under* low water to afford a complete obstacle to the waves to the required depth, but leaving, nevertheless, very ample space underneath for the constant passage of the tide or current. The upper part of such a breakwater would be sloped towards the sea, so as to form an inclined plane for the waves to expend themselves upon in mounting: the interior side of the masses, according to either of these modes, would be perpendicular, and by being hollow, might be converted to various useful purposes, whereby a compensation might be obtained for a considerable part of the expense.

"But, considering that a diminution of the water-way, even in the abovementioned lesser degree, would in some instances, at least, be objectionable; and what is of still more importance, that the building of piers or works of masonry of any kind at the entrance of a port, is in fact the forming of artificial rocks, against which ships are as likely to be carried to their destruction, as against natural rocks; I thought it expedient to contrive other means of producing the desired effect, which should be free from this objection, in consequence of which, the mode of forming a breakwater which I should propose in preference, as well to those of masonry built according to my modes, as to any other, is as follows:

"To make *floating* breakwaters in separate parts; or floats of wood in preference, because that material is sufficiently buoyant without the need for depending on any cavities which might be liable to be filled with water: to make these floats of a triangular, or rather prismatic form; and to hold them in their places by means of iron chains.

"Breakwaters, such as these, would not only leave the whole of the water-way uninterrupted below them, but would also allow a great part of the tide to pass through them; they might therefore be extended all across the entrance, so as to afford their protection to the whole of the sound within it, leaving only in certain parts sufficient intervals between the rows of floats, as well as between the contiguous floats, to allow of ships shaping their course between them: more especially since, in the event of a ship striking against, or even running over one of these breakwaters, it would not be likely that such an accident would occasion any material injury to the ship, any more than to the breakwater.

"A farther advantage of these breakwaters, which must be considered of no small importance, is, that no mischief whatever can be conceived likely to arise to any harbour from the employment of them; they may be tried in different parts of the harbour, till experience shall have pointed out the most advantageous situation for them; or they might be taken away, and be employed elsewhere, whenever circumstances might render it desirable. I have also to observe, that this proposal of mine is not founded on theory alone, since I have seen breakwaters constructed on the same principle, though not in the same manner, in a foreign port, where their good effect was fully exemplified; and, indeed, I have on one occasion caused one on a small scale to be employed with good effect at Sheerness.

(Signed) "S. BENTHAM,

"October 4, 1811.

"(Copy)

"R. A. Nelson,

"(Secretary to the Navy Board.)

"Estimated expense of a breakwater, 7,000 feet in length, by distant masses of masonry; also of a floating breakwater of the same length, formed by floats of wood.

"If of stone, according to the first mode:

"A circular mass of stone 50 feet diameter, 50 feet high, the bottom and sides of an average thickness of 6 feet, of which 2 feet in thickness on the outsides, set in Roman cement and sand, a strong coping set in

cement only, and the rest in good under-water mortar........................ £1,568

"Levelling and preparing the bottom of one mass	100
"Transporting and depositing one mass	100
	£1,768
"140 number of masses as above	247,520
"Contingencies on ditto, at 15 per cent.....................	37,128
Grand total......	£284,648

"If of stone, according to the second mode: Although a breakwater of this construction would require less masonry, yet as the execution would require a little more care and accuracy, the expense may be considered the same as the former mode.

"*For a Floating Breakwater of Wood.*

"One float, 30 feet in breadth and depth, 60 feet in length, paid over with oil of tar or other cheap oil....	£970
"Four mooring chains and fastenings	430
"Laying down the moorings of one float	100
	£1,500
"117 floats as above........	£175,500
"Preparation and other contingencies on ditto, at 15 per cent..	26,325
Grand total......	£201,825

"S. B.

"(Copy)
"R. A. Nelson."

It has been stated as an objection to floating breakwaters of wood, that they would be liable to destruction from the sea worm; but Sir S. Bentham, by previous experiments he had caused to be made in Plymouth Sound, had ascertained that wood paid with oil was not attacked by them, while other similar wood, *un*-oiled, submerged for comparison beside it, was speedily destroyed by the worm, as specified in Naval Papers, No. 6, pages 18 and 19.*

In regard to the *comparative* expense of a floating, or of a fixed breakwater, as that in Plymouth Sound: the estimate for a floating one of equal extent, it appears above was 201,825*l.*, calculated on the then war prices of timber and workmanship. The existing stone breakwater has cost at least two millions, and this money was borrowed at a rate of interest on the average of, at least, five per cent. The nation is therefore paying every two years as much interest for this breakwater as for the whole cost of a floating one. Supposing a floating breakwater to be renewed every ten years, the adoption of such a one, in this case, would have been a saving of 800,000*l.* every ten years, and so on for ever. In lesser works, the saving would, of course, be to less amount, though in proportion equally great by the adoption of such floating breakwaters.

In all late projects for floating breakwaters, it would seem that a *single* row of floats only has been intended; whereas, according to Sir S. B.'s plan, a *double* row was designed, whereby the waves would be more effectually broken, besides other minor advantages resulting from this arrangement. I am, Sir, yours, &c.

M. S. B.

* Longman and Co., 1828.

FOREIGN SCIENCE.

Turf employed in its natural and compressed state. By Dr. C. Schafhautl. 1844.

Dr. Schafhautl's name is already somewhat familiar to the British scientific public, from his having presented it with several very long-winded, and quasi-experimental papers on iron, &c., in which, after having turned over the mass of chaff in search of the grain of corn, we are obliged to confess our inability to discover a single seed for mental food of any sort. Yet there is no want, upon the face of these papers, of an air of profound experimental research and accuracy. The Doctor's analyses, or at least the columns of figures given as the results of such, never content him unless the weights reach the *third or fourth place of decimals*, while poor rough English chemists are content to stop at the second place, and gravely assure us that neither their balances, nor the limits of experimental error will enable them to go nearer: and indeed to this view we are ourselves so stupidly wedded, that we always regard with a strong prejudice, or perhaps suspicion, statements of analytical results which are ambitious of the fourth decimal place, and *show no loss* of weight by the operation. We observe that Dr. Thomson, of Glasgow, recently declared himself of the same antiquated view.

The Doctor's lengthy papers, in the *Philosophical Magazine* and elsewhere, appear, however, to have engaged the attention of no one beyond the compo-

sitor and reader. A more fortunate fate awaited one presented to the Institution of Civil Engineers by the Doctor, and by the wisdom of its Council rewarded with no less than a Telford medal. The paper is a beautiful example of the chemico-microscopic method of engineering, deducing certain inapprehensible conclusions as to some supposed *percussive* action of steam, &c., to blow up steam boilers, from experiments made by burning half a grain of potassium on the surface of water in a glass tube!

Dr. Schafhautl appears to be one of those gentlemen of no particular calling or vocation, who live from day to day, in and by, making inventions; and his last appears to be a new machine for pressing turf, of which all that need be said is, that it is a very old and inefficient machine for making bricks of clay, now applied to make bricks of turf.

Upon this machine, and in eulogium of its virtues and qualities, the Doctor has published a long paper in *Jobard's Journal.* One might have supposed that he imagined this paper would never meet an English eye, for it certainly does contain some most astounding statements. For example, it appears the Doctor has been in Ireland; and after stating that charred turf has been found (as is well known) so friable and tender as to crush down when attempted to be used in smelting furnaces for cast iron, and "gob the furnace," from being incapable of "bearing the burden," to use the technical phrases, he proceeds to say, that the charcoal of *compressed* turf is not so; that it is "hard enough to bear the heaviest charges," and that "il y a déjà plus de trois ans que j'ai mis en activité, en Irlande deux fourneux de fusion, marchant à la tourbe comprimé, et qui livrent des fers d'une qualité tout-à-fait superieure."

Suffice it to say that there is not an iron furnace at work in all Ireland of any sort, nor has there been within three years; nor has there ever been a furnace in blast with compressed turf charcoal! This is odd; but hear the Doctor further: "Les moores de l'Irlande s'élèvent parfois au point de formes des collines considérables. Ces marais engazonnés servent de pâturage, et il existe *des villages, des domaines, et des établissements divers sur ces terrains* tourbeux et sur le sol des moores, *qui lui-même est flottant*, sur une épaisseur considérable, à la surface des eaux, provenants principalement des pluies, et qui s'écoulent en hiver des montagnes voisines. Les eaux soulèvent de temps en temps la tourbe, *en font flotter les masses avec toutes les constructions qu'elles portent depuis le pied des montagnes jusque vers le rivage de la mer.* On a, en effet, constaté officiellement, et par mesures directes, le soulèvement, et le transport par ce moyen, *de plusieurs villages Irlandais.*" This is choice! it could not be improved; in serious, solemn, fun-provoking absurdity, as Paddy says, it "bangs Banagher." Only imagine the uncomfortable quarters which the "natives" of these "towns, domains, and establishments," must occupy who are thus afloat upon these newly discovered bogs—moving about at the mercy of the elements—liable to be shipwrecked against some neighbouring mountain—or liable any fine morning to waken and discover that their "towns, domains, and establishments" have moved down and gone to sea during the night, and that they are going to emigrate, with all they possess in the world, upon bog *bottoms*, which they have never chartered, nor regularly entered at Lloyd's. Let the reader not be incredulous, for the learned Dr. Schafhautl assures us that it has been "constaté officiellement," that thus "many Irish villages" have been transported. What an unhappy country that must be, between the repeal agitation and this unfortunate wandering propensity, "des vastes marais tourbeux, c'est-à-dire le sixième de toute la surface du pays!"

Why did not he add that Ireland is thus poor because, although its towns are adrift, it has not a *floating capital?*

But to be serious, we have in the two quotations given enough to enable all our readers hereafter to form a correct opinion of this Dousterswivel's veracity, and of his accuracy and intelligence; the latter evidenced by the absurdities he has engendered between some imperfect knowledge of the Irish Bog Commission Report, and the mystification he has no doubt received as to *the* moving bog from some waggish Patlander,—a bog which some years since moved, not out to sea with all its crew and cargo on board, but rolled a mass of fluid mud and peat a few hundred yards from where it had been at anchor from the time of Noah and his ark.

Expansion of Glass.

Ditné, in his great Memoir on the compression of liquids, published recently, had occasion, in order to be able to eliminate from his results the error due to the expansion under pressure of the glass vessels in which he experimented, to determine the degree of expansion of glass. He finds that the linear expansion of glass is equal to eleven ten-millionths of its own length for each atmosphere; that is, for each pressure of 15 lbs. per square inch, in round numbers. This is valuable to engineers, as regards manometer gauges of high-pressure engines.

The Phenomena of Soap-bubbles.

Professor Marianini, whose researches in some of the most delicate and recondite branches of physics have shed a lustre upon the science of Italy, has lately made some very curious observations upon the phenomena of soap bubbles, when placed in particular conditions.

He finds that when a common soap bubble is dropped into the mouth of a large and tall cylindrical glass jar, about one-third of its height filled with carbonic acid gas, it descends to the surface of this gas; and after a few oscillations up and down, due to its accelerated descent in falling, it floats stably upon the surface of the dense gas; but after the lapse of about one-third of a minute, the bubble begins sensibly to swell, and it continues rapidly to increase in magnitude until its volume is more than twice its original one, while at the same time it sinks deeper in the carbonic acid gas, showing that, notwithstanding its increase of volume, its specific gravity has increased also. As it sinks in the carbonic acid the rate of increase of its volume rapidly augments, and at last with such speed and force that the bubble bursts, the most beautiful and brilliant irridescence covering it at the last moments of its existence. It either falls at last to the bottom, and breaks on touching it, or bursts previously; showing such tension in the included gas, that the force of the rupture scatters minute drops of the soapy fluid against the sides of the jar.

The Professor finds the same phenomena, differing in time and in intensity, with bubbles blown of various other gases as well as common air, and floated on carbonic acid; and lastly, he finds these bubbles may be blown so as to float stably in still air about 4 feet from the ground, and that in such cases they do not swell or burst.

To account for this new and very beautiful experiment Marianini considers that the phenomena are to be attributed to a sort of gaseous endosmose; that is to say, that the carbonic acid penetrates through the very thin envelope of the bubble, swells it, dilates it, and augments its weight. This appears to be near the truth, but not precisely the truth itself. Endosmose—which means the transmission either of one current, or of two opposite ones, through bodies (generally organized) whose porosity is of such a nature as to permit the access and passage of one fluid, and prevent that of another—cannot be affirmed to have any known existence through a fluid diaphragm of any sort. No case has ever been observed, or seems even pos-ible. Hence endosmose can have no place here. Yet it is quite true that the carbonic acid does get into the bubble, and through the medium of the fluid too; but the means seems to be this—the outer surface of the thin wall or *parenchyme* of the bubble, becomes by the affinity of carbonic acid for water, charged with the gas. But the next lamina, or thin plate of fluid, (viz. soapy water,) within this has also an unsatisfied affinity for carbonic acid, and in virtue of this it robs the outer film of part of its acid just absorbed; and so on, by the process which Becquerell has called "cementation," from its resemblance to that by which iron absorbs carbon in its conversion into steel, the whole substance of the bubble keeps continually passing carbonic acid from particle to particle of its substance inwards, until reaching its inner surface the carbonic acid is in part given up to the atmospheric air, or other gas within, and mingles with it in virtue of the well-known law of diffusion of gases, producing dilation, increase of specific gravity, &c. The increased rate of expansion of course arises from the circumstance of the whole surface of the bubble becoming immersed in the gas, and probably also from its immersion in the denser medium increasing the pressure with which, or in proportion to which, the fluid of the bubble absorbs carbonic acid.

Such appears to be the true solution of a singularly elegant experiment, and one eminently suitable for popular ex-

hibition. It seems even possible to make the arrangement one capable of determining experimentally several questions relating to the rates of absorption of gases by fluids and of their respective affinities, and of verifying the law of diffusion by modifying its conditions and changing the respective gases, within and without. How beautiful the experiment might be made upon a brewer's large fermenting tun,—when there are several feet in depth of carbonic acid!

Red-hot process of producing Artificial Ice.

One of the most singularly beautiful experiments perhaps ever devised, has been recently published by M. Prevostaire, illustrative of the repellent power of heat radiating from bodies at a high temperature, and of the rapid abstraction of heat, produced by evaporation, or generally by such a change of condition as largely increases the volume of any body. The experiment is simply this:—A platina crucible is made and maintained red-hot over a large spirit lamp. Some sulphur*ous* acid is poured into it from a pipette. This acid, though at common temperatures one of the most volatile of known bodies, possesses the singular property of remaining fixed in the red-hot crucible and not a drop of it evaporates; in fact, it is not in contact with the crucible, but has an atmosphere of its own interposed. A few drops of common water are now added to the sulphurous acid in the red-hot crucible. The diluted acid gets into immediate contact with the heated metal—instantly flashes off into sulphurous acid vapour, and such is the rapidity and energy of the evaporation, that the water remains behind, and is found frozen into a lump of ice in the red-hot crucible, from which, seizing the moment before it again melts, it may be thrown out before the eyes of the astonished observer.

Here is an experiment for the Polytechnic Institution—a piece of natural magic, as much like a miracle as any merely human wielding of the forces of nature can produce.

Tobacco.

Professor Zeise, of Copenhagen, has lately made an elaborate investigation of the products of the dry distillation or slow burning in air of tobacco. Although the history of the peculiar principle of nicotin, to which tobacco owes most of its powers, but which is the product of the particular sort of fermentation to which it is submitted, and does not exist in the natural plant at all, is already known, little or nothing precise has been hitherto ascertained as to the changes induced in tobacco by destructive distillation, such as it is submitted to in the pipe of the smoker. The details of Zeise's paper would be unsuitable for the pages of this Magazine, but, for the information of those "who breathe the witching weed," the following catalogue may be extracted from Zeise of the materials which they so gratefully inhale and take into mouth and lungs. He says the principal constituents of tobacco smoke are:—a peculiar empyreumatic oil; byturic acid; carbonic acid; ammonia; paraffine; and certain compounds allied to the resins. It becomes thus evident why smoking staves off hunger. The reason why the smoke of tobacco does not irritate the eyes, &c., in the same way as that of wood does, is that it contains no creosote. Zeise's experiments were made chiefly upon tobacco known by the names in the commerce of Denmark, of Porto Rico, and Bischof, No. 2. Vauquelin, Porfelt and Reimann, with Unverdorben are the other continental chemists to whom the chemical history of tobacco is indebted.

R. M.

WOLFERSTAN'S SAFETY BOILER TAP.

(Registered under the Act for the protection of Articles of Utility. Thomas Wolferstan, of Salisbury, Iron Founder, Proprietor.)

The class of boilers to which this tap is more particularly applicable, are those employed in kitchens to furnish constant supplies of hot water for domestic purposes,—which every one of a house has recourse to, and every one is so apt to leave somebody else to look after, that they are attended to by nobody, fail often to yield the supply wanted, and are not unfrequently burnt through and destroyed. With this tap applied to them, such boilers will in future be at once exhaustless, and (except by length of use) indestructible. Exactly in the same proportion as you draw off hot water you must let in cold; you cannot abstract the one without adding the other. Burning can never possibly take place, for the boiler can never possibly be empty—n- less, indeed, the supply of cold wat-

intentionally and wantonly cut off. We have seen many contrivances professing to have the same object in view, but none, which is on the whole so perfectly effectual, and at the same time so cheap and simple.

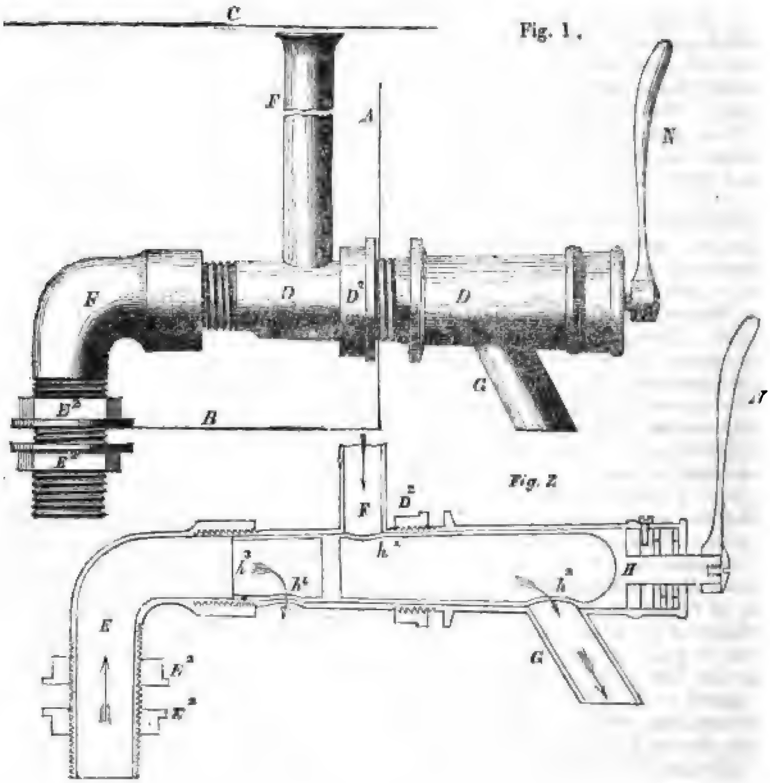
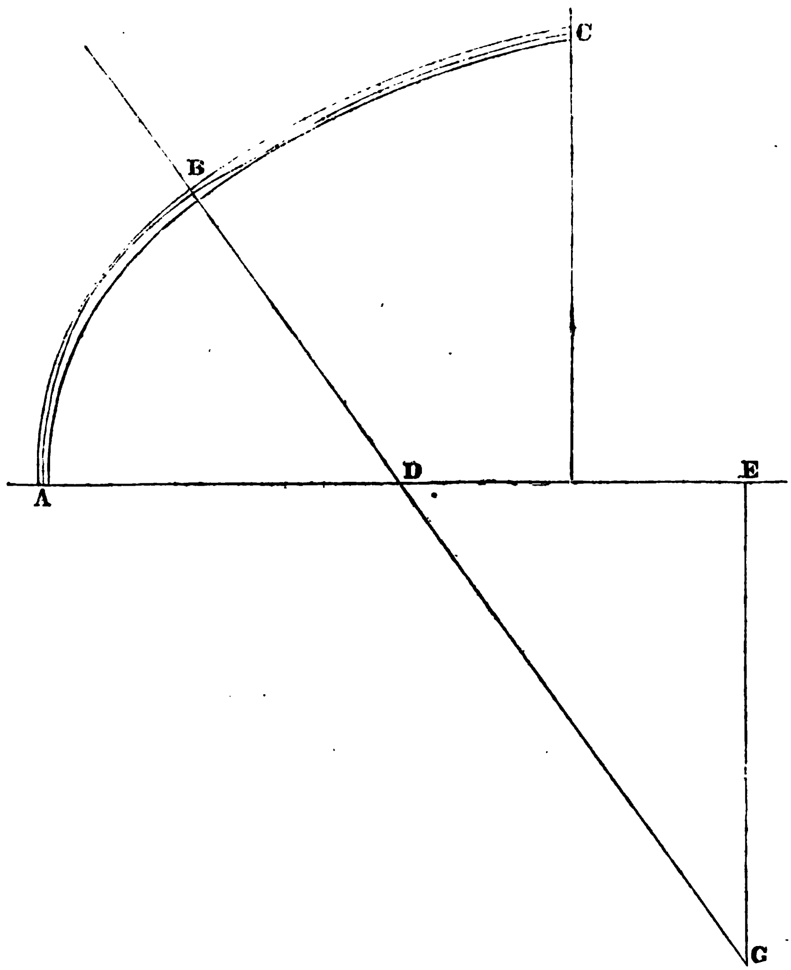


Fig. 1 is an external view of this tap; and fig. 2 a horizontal section. The vertical line A represents the front of the boiler; the horizontal line B, the bottom, and C the hot water line. D is the barrel of the tap, which is open at the inner end, and after being passed to the extent shown through the front plate of the boiler, is screwed into the curved end of the pipe E, which leads to a cold water cistern, placed in any convenient situation. D^2 is a nut by which the barrel is screwed up tight into its place. E^2 E^2, nuts by which the pipe E is made fast. F is a pipe, which rises vertically from the part of the barrel immediately behind the front plate of the boiler to the surface of the hot water. G is a pipe for the out-flow of the hot water from the tap. H is the plug; h^1, the water-way, which, being opened to the vertical pipe F, admits the hot water; h^2, the water-way for the escape of the hot water; h^3, a circular recess in the end of the plug which is open to the cold water supply pipe E, and h^4, a water-way cut into the recess h^3.

The three water-ways, h^1, h^2 and h^4, are so arranged in point of position with respect to one another, that when any one of them is opened by the turning of the plug by means of the handle N, all the three shall be opened. The result is, that as often as hot water is drawn off from the boiler an equal quantity of cold water is admitted to it, and that at a point where it can have but little, if any effect on the temperature of the water at the surface. The boiler is thus always kept more or less filled, and all danger of destruction or injury to it from the metal being left uncovered with water is prevented,

TUDOR ARCH—FROM A DOORWAY IN CROYDON PALACE, SHOWING BY FAIR LINES THAT THE PRESENT COMMON MODE OF DRAWING SUCH ARCHES IS IMPERFECT, AND ILLUSTRATING THE UTILITY OF MR. JOPLING'S SEPTENARY SYSTEM OF GENERATING LINES BY CONTINUOUS MOTION.



The interior line, A B C, is described at twice from the centres D and G, according to the data given by T. L. in the *Builder*, page 304; each portion being of uniform curvature, while the radius of the one is approaching to three times the length of the other. With this variation, two arcs from different circles are *patched together* to form what many are taught to think, and appear to be satisfied, is a fair curve, proving that both mind and eye require instruction.

On each side of the middle line, thus drawn, is described another by simple continuous motion, with a continual variation of curvature from A to C; and it will be observed, that a fair line of the same character, half way between them, would pass through the three points, A B C, of the approximate line, showing

that it (which from the mode of generation alone ought to be manifest) is too quick immediately below B, and too flat above that point. In short, the true line would deviate just so much from the approximate method as is necessary to produce a fair curve passing through the three points, and that a tangent to the point A be perpendicular to the horizontal or springing line.

The approximate method of producing an imitation of an ellipse by patching together portions of four circles, might in a similar way be made as obviously inaccurate to an untutored eye; and every eye, and mind too, must be untaught, which cannot perceive the inaccuracy without such explanation; and consequently cannot contemplate any varying form of an object so as to acquire a true impression of the different parts.

On a small scale—unless it is by a very delicate engraving—it is difficult to show the precise character of either the approximate or the true curve. On the other hand, the larger they are drawn, the more obvious the imperfection and the truth.

It is supposed however, after seeing this, that there are few architects, if they will allow the eye, and the mind too, to dwell for a sufficient time on any arch, a large one especially, who will not immediately discover the character. In this way ancient forms ought to be compared with modern constructions. But suppose the ancients had not arrived at a knowledge of a strictly fair line, does it follow that an imperfect line should be continued, when an accurate one may be applied with greater facility? Yet perhaps the fair line may be found to approach as nearly to the form of the Croydon arch, as the approximate one, if a curve formed by continuous mode of generation were applied to it.

JOSEPH JOPLING.

29, Wimpole-street, June 24, 1844.

THE AMERICAN PATENT OFFICE AND PROGRESS OF THE MECHANICAL ARTS IN THE UNITED STATES.

The Hon. Henry L. Ellsworth, the present Commissioner of Patents for the United States, has been in the practice, since his appointment to that office, of publishing Annual Reports, embracing not only the transactions of the department of state under his immediate superintendance, but the progress generally of his countrymen in the industrial arts; and while these Reports have borne honourable testimony to the zeal, diligence, and ability with which Mr. Ellsworth has discharged the duties of his office, they have furnished much interesting matter for observation and reflection, as well to foreign lookers-on, as to his own countrymen. Every year these Reports have been increasing in magnitude, till at length we have for the year last past, an entire volume, of 335 pages, large octavo, and closely printed. The bulk of the volume, however, is no further objectionable than as it makes it difficult, within the limits of a critical notice, to convey an adequate notion of the value and importance of its very multifarious contents.

The total number of patents issued by the United States, up to the end of 1843, appears to have been 13,523. The number granted in 1843 was 541; applied for, 819. The receipts of the Patent Office during 1843 were 35,310 dollars; the amount returned to unsuccessful applicants 526 D.

Of the benefits conferred by this vast influx of inventions (real or supposed) Mr. Ellsworth entertains a very exalted opinion. "The advancement of the arts," he says, "from year to year taxes our credulity, and seems *to presage the arrival of that period when human inventions must end.*" Is not this rather extravagant? We incline, for our own parts, to think that when the period does arrive "when human inventions must end," the end of the world itself cannot be far distant. The advancement of the arts of late years, both in the Old and New Worlds, has certainly been very great; but not so much so, surely, as to warrant any such disquieting apprehensions. Even as regards the contributions of our transatlantic friends to the common stock of mechanical knowledge, it must be confessed—their prolific ingenuity and intense go-a-headedness notwithstanding—that they are more remarkable for number than value. We cannot boast much of the quality of our own Patent Lists; but such as they are they bear a

marked superiority to those of the United States. Both abound in crudities, frivolities, and absurdities; but in the case of the American lists, the proportion of such trash is much larger than in ours, and the instances also are of a much grosser sort, betokening that they are the offspring—as is the fact—of a much ruder and less informed state of society. The *Franklin Journal* gives from time to time selections from the stores of the Patent Office at Washington, and the *Mechanics' Magazine* culls from these selections again such as may seem most likely to interest the English public; but how few, even of these twice-sifted specimens, can be said to have retained any hold on the minds of mechanical men? Of the 541 inventions stated to have been patented during the last year, we should not, from past experience, expect that more than one in twenty are good for anything.

The most important novelty noticed by Mr. Ellsworth is a hosiery power-loom, which we do not think has yet found its way into this country. To knit by hand two pairs of drawers is said to be a full day's work for a girl earning 2 dollars 50 cents per week; while the new power loom will produce twenty pairs in the same time. A piece 28 inches in width, and 1 inch long, can be knit in one minute. A reduction of about nine-tenths has been thus effected in the cost of manufacturing this class of articles. The total quantity of hosiery used in the United States annually is valued at 2,500,000 D., and of this not more than one fifth is supposed to be of home production. A great change in these proportions is reasonably anticipated from the introduction of the new machine.

A land scooping machine is mentioned, by which no less than *ten miles* of ditches, 14 inches deep and 28 inches wide at top can be excavated in one day, at an expense of 3 cents per rod. It requires 10 yoke of oxen and 5 hands to work it.

The process of hardening wood by impregnating it with sulphate of iron, is stated to have been adopted with great success in the case of the American railroads and plank roads. Wood thus treated has been rendered so hard that, after being travelled over for a twelvemonth, it has not exhibited the smallest traces of the wheels.

Some facts are mentioned with respect to ventilation, founded on the experience of the Patent office itself, which are curious, and rather at variance with the notions commonly entertained on the subject.

"Ventilation is often obtained through the ceiling only, but so far as it respects rooms heated by hot-air furnaces only, this method is an incorrect one. If the temperature of the different parts of the room is tested by a thermometer, it will be found that the upper part heats first; and if no outlet is given, the draught of hot air ceases, the room being filled. Let an aperture be made at the top of the room, and the warm air instantly escapes; but if an opening is made near the floor, the cold air within the room passes out and the warm air descends to fill the space. An experiment, proving this, was tried by drying clothes in a room without ventilation, heated by air furnaces; the clothes that were in the upper part of the room dried well, while those in the lower part still continued moist. As soon, however, as an aperture was made for ventilation below, a draught was given to the furnace, the cold air expelled, and the clothes dried rapidly."

The necessity thus evidenced of combining ventilation with any process of heating which may be adopted, forms the ground work of the patent recently taken out in our own country by Messrs. Davison and Symington for drying and seasoning casks, &c., of which we gave a full account in our No. 1085.

On butter casks there are some useful hints. It has been observed, that every sort of wood which contains pyroligneous acid is unfit for this purpose; because of the acid tending to decompose the salt in the butter. The linden or bass wood appears from careful experiment to be the only sort that is free from it. Other woods may, however, be freed from the pyroligneous acid by boiling for three or four hours, and then pressing under water.

The following account is given of a process said to have been long kept a secret, by which butter may be kept fresh and sweet for years in any climate.

"The butter is to be well churned, and worked and packed hard and tight in kegs of seasoned white oak; the head is then put in, leaving a small hole into which brine is poured to fill the vacant space; and of so much importance is it deemed, to prevent any bad taste, that the plugs for the hole must not be made of cedar or pine, but of cypress or bass wood, as otherwise it would be injured. After which, these kegs are placed in hogsheads well filled with brine of full solution, that will bear an egg, which is then headed up tight and close."

The gain to the community from the progress of invention is illustrated by a number of very instructive instances.

"The rapid improvements of the arts may help to account for the reduction of price as to many articles of manufacture, and especially in some that are usually ranked among the necessaries of life. Individuals now in Congress can recollect of having, thirty years since, purchased shirting at 62½ cents per yard, who the last year have bought that which was equally good for 11 cents a yard only. The little article of hooks and eyes is another illustration of the same progress of inventive industry. Thirty years ago, the price was 1·50D, the gross pairs; now, the same quantity may be purchased from 15 to 20 cents. At one establishment in New Britain, Connecticut, 80,000 to 100,000 pairs per day are made and plated by a galvanic battery, or the cold silver process. The value of this article consumed in a year in this country is said to be 750,000D. Another article very essential to the husbandman, *horse-shoes*, furnishes a similar proof of the bearing of the progress of inventions. An improved kind of horse-shoes made at Troy, New York, for some time past, is now sold at the price of only five cents per pound, ready prepared to be used in shoeing the animal. At a factory recently erected, 50 tons of these are now turned out per day; and it is thought they can be made and sent to Europe at as good a profit, as is derived from American clocks, which have handsomely remunerated the exporter."

Among the services rendered by the American Patent Office, there is one, which though it does not fall very legitimately within its domain, is nevertheless of a highly useful character, and is perhaps performed by it at less expense and trouble than if it were assigned to any other department; we allude to the important aid which it has furnished to the farming interests of the United States. During the lest year no less than twelve thousand packages of seeds and plants, of new and improved sorts, were forwarded from this office to all parts of the Union. Mr. Ellsworth, to show the probable advantages to be derived from this source, calculates that an improvement of 10 per cent. on the agricultural produce of the country would amount to 30,000,000 D. annually. Mention is made of a hardy kind of rice which flourishes on the edge of the snows of the Himalaya mountains, and which Mr. Ellsworth thinks will thrive equally well in some parts of the Union. The opinion is now general, as well in Europe (we believe) as in the United States, that wherever Indian corn will ripen upland rice may be grown. The multicole rye of the west of France is another species of grain from the introduction of which into the United States, great hopes are stated to be entertained.

Mr. Ellsworth gives a higher estimate than we have yet seen of the population of the American Union. According to him, it is now close on 20 millions (19,183,583); and the increase, since 1810, has been 2,114,130. What an infant offspring this, for a mother country to glory in! The total population of Great Britain and Ireland was, at the date of the last census (1841) only 18,844,434.

GALVANIC EXPLOSION OF GUNPOWDER BY DOUBLE AND SINGLE METALLIC CIRCUITS.

We quote from a long account given in the *Times* of the operations now going on at Spithead for the removal of the remains of the *Edgar*, by the same means which have been so successfully employed in the case of the *Royal George*, the following statement of the results of a trial which has been made of Mr. Bain's plan of using a single wire only for the transmission of the electric current. The writer calls this "Lieut. Hutchinson's ingenious plan;" but this is the first we have heard of that gentleman's laying any claim to it. We feel quite sure that Lieut. Hutchinson himself would be the last to dispute Mr. Bain's prior claim.

"Lieut. Barlow, the present executive engineer officer at Spithead, has tried nume-

rous experiments in the firing of gunpowder by the voltaic battery, partly with the service charges used in breaking up the timbers of the wreck, in tin cans not usually exceeding from 44 lbs. to 55 lbs. of gunpowder, and partly with small experimental charges of a few ounces, by desire of General Pasley, who wished to carry out Lieut. Hutchinson's ingenious plan of firing submarine charges by one conducting wire only, instead of two, using the water of the sea to complete the electric circuit. In these experiments Lieut. Barlow first found that it was unnecessary to let down a piece of wire with zink plates attached to it from the voltaic battery into the water, as had been done by Lieut. Hutchinson, for the circuit was equally good when the wire alone was used; and on repeating those experiments in General Pasley's presence, the correctness of this principle was sufficiently proved, but a difficulty occurred, which had not been experienced before—viz., that it required two plate batteries of ten cells each, to fire a charge at the distance of 200 feet, with the single wire, whereas one of Prof. Daniell's batteries of eight cells only, which is inferior in power to a plate battery of ten cells, had always fired submarine changes instantaneously in former years by the double wire, which circumstance had not been adverted to by Lieut. Barlow, as this was his first season. General Pasley, therefore, concluded that the firing charges with one conducting wire, instead of two, might diminish the power of voltaic electricity more than had been suspected last year, when this change was introduced so very late in the season, that there was not time to investigate the result of it in all its bearings; and, consequently, he directed that two conducting wires on reels, the same that had failed in igniting a charge when attached singly to less than a twenty cell plate battery, should be attached to one plate battery of ten cells, on the original principle, used at Chatham and Spithead, from 1838 to the middle of 1843 inclusive, so that these two wires, were insulated, connected that battery and a charge at the bottom, without trusting to the water. On adopting this arrangement, instantaneous explosion took place, as soon as the circuit was completed. Thus the double metallic circuit was proved to be the best for firing gunpowder, whether underground or under water, and will as such be exclusively used in all future explosions; though for the purposes of an electric telegraph, which requires wires to be laid for many miles, and which needs infinitely less power than is necessary for the firing of gunpowder, water or moist earth, especially the former, may be used to advantage for completing the circuit, in combination with one wire only, extending the whole length of the telegraphic line."

THE WOOD-PAVING PATENTS.

The Judgment of Lord Chief Justice Tindal in re *Stead* v. *Williams*. 29 *June*, 1844.

[We gave a brief notice last week of this important judgment. We now insert a literal copy of the judgment taken from the short-hand writer's notes.]

Lord Chief Justice Tindal.—This was an action for the infringement of a patent granted for an invention for making or paving public streets and highways, and public and private roads, courts, and bridges, with timber or wooden blocks. The defendant pleaded that the plaintiff was not the first and true inventor of the said invention in the letters patent and specification mentioned, besides various other pleas which it is not necessary to particularize with reference to the present motion. Upon the trial at the last summer assizes at Liverpool, before my brother Cresswell, a verdict was found for the plaintiff, and a rule *nisi* was afterwards granted for a new trial; and upon the report of the learned judge it appeared that, before the granting of the letters patent to the plaintiff, there had been published in a scientific work in England a letter from a gentleman of the name of Heard, containing such a description of a mode of paving with blocks as made it fit to be submitted to the consideration of the jury as not differing substantially from the invention for which the patent was granted. It appears also that, in summing up the evidence with reference to the letter above adverted to, the jury were told in substance that, if they thought the patentee had borrowed his invention from the publication which had been proved, he could not be considered as the first inventor. So also that, if the letter had been so far communicated to the public as to have become a part of the public stock of information, and he had thus obtained his knowledge indirectly from the publication, that he was not to be considered as the first inventor within the meaning of the statute. Upon the discussion before us it was contended that this mode of summing up, although undoubtedly correct so far as it went, yet did not present the entire view of the case to the consideration of the jury; for it was argued that if the invention had been communicated to the English public, although it had never directly or indirectly come to the knowledge of the patentee, still he could not be considered as the inventor. It was admitted on the part of the defendant that no case could be cited in which the point had been expressly decided; but it was contended that, in point of reason and principle, such must be held to be the case; for if the

invention had already been communicated to the public, it would be unreasonable that they should lose the benefit of it, and be restricted from making use of it by a patent taken out by one whose claim to such patent could only be supported on the ground, of his being ignorant of that which had been already communicated to the rest of the world; and though no decided case was cited, various dicta of various judges were referred to in support of the view as contended for by the defendant, particularly what was said by Mr. Baron Alderson, in Carpenter and Smith, 9 Meesom and Welsby, 902, and the observation made by Lord Lyndhurst, and other Lords of the Privy Council, as reported in 1st vol. Webster, 718. Lord Lyndhurst says, "If the machine is published in a book, distinctly and clearly described, corresponding with the description in the specification of the patent, though it has never been actually worked, is not that an answer to the patent? It is continually the practice on trials for patents, to read out of printed books, without reference to anything that has been done." Again he says, "If the invention is in use at the time the patent is granted, the man cannot have a patent, although he is the original inventor; if it is not in use he cannot obtain a patent if he is not the original inventor. He is not called the inventor who has in his closet invented it, but who does not communicate; the first person who discloses that invention to the public is considered as the inventor." Upon a full consideration of this subject we have come to the conclusion that the view taken by the defendant's counsel is substantially correct; for we think if the invention has been already made public by any description contained in a work, whether written or printed, which has been publicly circulated, in such case the patentee is not the first and true inventor within the meaning of the statute, whether he has himself borrowed his invention from such publication or not, because we think the public cannot be precluded from the right of using such information as they were already possessed of at the time the patent was granted. It is obvious that the application of this principle must depend upon the particular circumstances which are brought to bear upon each particular case. The existence of a single copy of the work, though printed, if brought from a depository where it has long been kept in a state of obscurity, would afford a very different inference from the production of an Encyclopædia, or other work in general circulation. The question will be, whether, upon the whole evidence, there has been such a publication as to make the description a part of the public stock of information? We think, therefore, as this question has not been submitted to the jury, there ought to be a new trial in this case.

SHAW'S MANUAL OF ELECTRO-METALLURGY—SECOND EDITION.*

We are glad to find the favourable opinion we expressed of this "Manual" on its first appearance, confirmed by such unequivocal facts, as an extensive sale and increasing demand. We then pronounced it to be on the whole the best work for popular use which had been written on the subject, and we see no reason to think worse of it in its present "enlarged" form. The increase in bulk is caused chiefly by the addition of those improvements and discoveries which have been made in electro-metallurgy since the publication of the first edition, and is equivalent, therefore, to increase of value. The work has been also much improved by the adoption of a more methodical arrangement of the matter of it into chapters and sections, and by the addition of a good index.

In the first edition the author, partaking of the common delusion on the subject, had ascribed to Mr. Spencer the first successful application of electricity to the arts; but enlightened by the papers on this point which have recently appeared in our journal, he now quietly drops him into that lower place in the scale of merit, which he seems destined to fill throughout all future history. After quoting at length the communication from Mr. Jordan to the *Mechanics' Magazine*, Mr. Shaw observes,—

"The letter of Mr. Jordan, in the *Mechanics' Magazine* attracted so little attention, that it had been overlooked; and probably would have remained unknown, had not Mr. Dircks, of Manchester, called attention to it in a recent number (1069) of that journal. It will be observed that Mr. Jordan anticipated all the most important parts of Mr. Spencer's communication, and must now take the position so long occupied by Mr. Spencer—that of the author of the earliest successful application of electricity to the arts.

"In studying the history of the art of electro-metallurgy, it should be borne in mind that the individual who will eventually be regarded as the originator of the art,

* A Manual of Electro-metallurgy, By George Shaw. Second edition, considerably enlarged. 202 pp. 8vo. 1844.

cannot claim to be ranked as a discoverer;—the art in question consists in the application of facts, already matters of notoriety, to some useful or ornamental purpose. The announcements of Mr. Jordan and Mr. Spencer contain no discovery, so far as obtaining impressions by galvanism is concerned, for the announcements of De la Rue and others contain every fact which those gentlemen pointed out; but while the philosophers contented themselves with noticing the exactness of the impression produced by voltaic precipitation, even to the 'polish' and counterpart of 'every scratch,' the printer and the carver and gilder apply themselves to the production of impressions of printers' type and medals by the same action. To them, then, belongs the merit usually reserved for practical men; that of applying facts which had hitherto been unapplied; of creating a new, beautiful, and valuable art from materials until then neglected, although within the reach of all.

"The position which Mr. Spencer has so long occupied as the earliest English experimenter in this art, and which now clearly belongs to Mr. Jordan, cannot but excite the surprise of all who are interested in this art. It is surprising that the letter of Mr. Jordan to the *Mechanics' Magazine* should have been so long overlooked, and still more surprising that Mr. Jordan should have permitted the honour with which the origin of so important an art is associated to be appropriated by another. The supineness of Mr. Jordan is equalled by that of his friends, for it now appears that his claim to the origin of the art of electro-metallurgy was known to many individuals."

Mr. Shaw speaks very highly of Woolrich's magneto-plating process (described at length in the *Mechanics' Magazine* for Feb. 25, 1843), which is stated to be now extensively carried on by Mr. Prime, of Northwood-street, Birmingham:—

"The magneto-electric machine appears destined to supersede every other apparatus in the deposition of metals of low equivalent proportions, as the expense of the voltaic battery in such precipitations renders the process an expensive one. Thus, in depositing zink, as in zinking iron, supposing two cells, arranged as an intensity battery, to be employed, the quantity of zink deposited would be just one-half of that consumed in the battery, and very nearly the same proportion would obtain in the case of copper. Hence, the expense of depositing, compared with the value of the metal deposited, is very great; in the magnetic machine, on the contrary, the expense of depositing is limited to the power required to produce the rotation of the armatures.

"The uniformity of the current developed in the magneto-electric machine is not the least of the many advantages this machine possesses. In the best constant battery the quantity varies during the course of several hours; and even the best operators with the battery find it necessary to give close attention to the state of the instrument, and the progress of the deposition. With the magnetic machine the deposition goes on with extreme regularity; and, when once adjusted, may be left for any length of time without fear of derangement. So accurately is the deposition by this machine proportioned to the time of working, that in an establishment in Birmingham, where this process is extensively employed, the quantity of metal deposited is estimated by the time during which the machine works; repeated weighings having demonstrated that the relation between the time of working and quantity of deposited metal is sufficiently accurate."

When Mr. Shaw's work reaches another edition—which we run very little risk in predicting it will do soon—we would recommend him to favour his readers more frequently, with the sources from which his statements are derived. To omit authorities seems at present to be the rule with him; we hope to see it made the exception. A more uniform adherence to established orthography would also be desirable. *Deposite* and *deposites* are conceits not justified either by usage or analogy; and occurring so frequently as they do throughout the work, are offensive to the eye.

THAMES STEAMERS—THE "METEOR."

Sir,—Your correspondent "Curve," in No. 1090, 29th June, in describing the fast steamers, commences his observations upon the two last productions of the season, viz., the *Meteor* and the *Princess Mary*, and in his eulogy upon the beauty of the first named, seeks to found an impression that her *construction is exceedingly slight, even for river navigation.*

Having had opportunities of seeing the building of this beautiful vessel, and knowing the skill of her constructors to be a sufficient guarantee to the public from any invidious remarks made by "Curve," I challenge him to the proof of his assertion.

I have information which will establish the contrary, showing her build to be equal, if not *stronger*, than any of her competitors.

If "Curve" is in possession of any information, either from *open* or *secret* sources, he must be aware of this truth. I trust his explanation will be such as to give no room to suppose him capable of giving way to *party* feeling.

I am, Sir,

Your obedient servant,

W. Cormack.

Poplar, July 10, 1844.

NOTES AND NOTICES.

The Manufactures of Paisley.—At this moment, when the manufacturing skill of France is fostered and promoted by Government rewards and honours, it is exceedingly gratifying that the skill of our own native weavers has afforded another proof of their unsurpassed skill and industry. A scarf shawl has been submitted to us, the invention of Messrs. Graham and Smith, of Ludgate-street (late Everington and Graham). Four colours are so constructed as to fold into 20 different effects; either colour can be worn alone, any two together, three, or all four, according to the caprice of the wearer. Mr. Robert Kerr, of Paisley, is the enterprising manufacturer who has accomplished the weaving in one piece of this extraordinary shawl, which is pronounced to be a scientific production of far greater merit than anything of the kind that has yet appeared in the French exposition of manufactures.—*Times.* [If, then, private enterprize has been able of itself to accomplish so much, what need to sigh after "Government rewards and honours?"—Ed. M. M.]

Middleton's Chimney-pot and Cowl Sweeper.—(See *Mech. Mag.* No. 1087.)—We went the other day to see the New Palace at Riseholme, the residence of the Bishop of Lincoln, and one of the first objects that attracted our attention was the vanes of the chimney-pots moving about, although at the time there was scarcely any wind to cause a movement to be so general. Upon a nearer inspection our surprise was great when we recognized the identical "Middleton's Chimney-pot," "the thing" we were so desirous of inspecting, little dreaming that the inventor was a near neighbour. On inquiry we were informed the Palace chimneys smoked very badly, but that a radical cure had been performed by these pots. This is the first building the invention has been tried upon, and we calculate from its valuable but simple properties, that ere long every smoky chimney in the kingdom will be mounted with an article so useful.—*Lincoln Advertiser.*

The Tagus Steamer has undergone a complete refit at the factory of Messrs. Miller and Ravenhill. Her former boilers have been removed, and new ones on the double-storied tubular plan substituted, by which the following advantages are stated to have been realized:—A saving in space of about one-fifth as compared with the old; a less displacement by about 6 inches, the vessel floating that much lighter; an economy of weight of nearly 50 tons, the former boilers and water being nearly 130 tons, and the present 80 tons; an increase of power, by using a greater pressure on the steam valve with perfect safety, the present boilers working up to 25 per cent. of what they are proved capable of sustaining, and those of the old construction to 75 per cent. Nor are the boilers themselves the only improvement that has been made in the machinery department. A simple and very effective arrangement of the cut-off valves by Mr. Lamb has been adopted, and the supply of the oil to the bearers has been regulated by the adoption of Allen's lubricators (see *Mechanics' Mag.* 991), by which the consumption of oil is reduced to 30 per cent. of its former waste. The excellent blow-off valves of Mr. Kingston have also been brought to bear in their fullest extent, and to great advantage.

Coal-Breaking Machines.—(From the *Miners' Journal*, an American publication.)—Among the many improvements which have lately taken place in the business operations of this region, there is none more striking than the saving of expense in breaking and screening coal. A few years since every ton of coal which was broken for shipment cost from 30c. to 37½c. to reduce it to proper sizes, while now the expense will not much exceed one-fifth of this amount. This truly surprising result, like many others of a similar kind is the effect of machinery, and has been brought about by successive experiments and improvements. The attempt to break coal by machinery, we believe, was first made by Mr. Sabbaton, and afterwards by Mr. Larer, but not proving as successful as was anticipated, they were afterwards abandoned. Improvements were then made upon the old system of breaking with the hammer, and instead of breaking in the pile, cast-iron plates, with holes sufficiently large to allow coal of proper size to pass through, were used. This was found to diminish the expense considerably, making the cost of breaking about 20c. or 25c. per ton. A further improvement was then made by turning the screens by steam instead of hand, which caused a still further reduction in the expense of preparing the coal for market, the cost being from 12c. to 18c. per ton. But satisfactory as these results were, and greatly reduced as the expenses have been by these improvements, Mr. Battin, of Philadelphia, has improved upon them, and invented a coal-breaking machine, which will, in all probability, supersede every other invention of the kind, and eventually enrich its ingenious inventor. One of these machines was first erected at Mr. Bast's mines, for the purpose of breaking white ash coal, and found to answer every purpose intended; but, at the same time, fears were expressed that it could not be used to advantage in breaking the red ash. Subsequent events have shown that these fears were groundless, and a machine is now in operation at Milnes and Spencer's mines, by which the red ash is broken with no greater loss than on the cast-iron platform. Encouraged by these successful experiments, other machines are now in the course of erection at the collieries of Andrew B. White, and also at the Delaware Coal Co.'s works, the latter of which will, probably, go into operation during the present week, and the former the ensuing week. These machines, to work advantageously, require engines of about 20-horses power, and will break the coal at an expense of from 8c. to 10c. per ton, according to location, including 3c. per ton, which is paid the patentee. Another machine for the same purpose, but constructed upon an entirely different principle, we learn has been put in operation by the Beaver Meadow Coal Company. This machine consists of a square box, in which are several iron bars placed longitudinally at such distances apart as will make the coal of proper size, while a roller is so situated as to pass over and force the coal through the openings. The invention is favourably spoken of, and, will no doubt, answer a good purpose in breaking the white ash, although we learn the waste is much greater than that caused by Mr. Battin's machine.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1093.] SATURDAY, JULY 20, 1844. [Price 3*d.*

Edited by J. C. Robertson, No. 166, Fleet-street.

WARR'S REGISTERED COOKING APPARATUS.

Fig. 1.

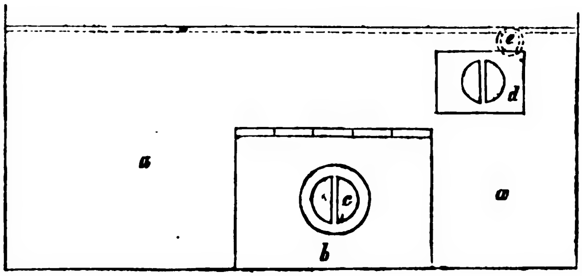


Fig. 2.

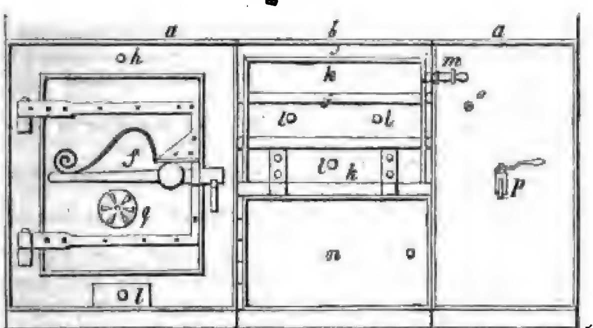


Fig. 3.

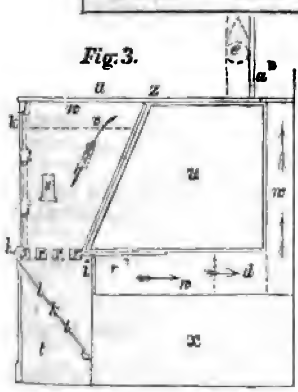
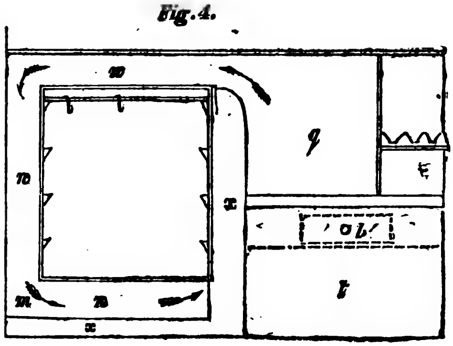


Fig. 4.



WARR'S COOKING APPARATUS.

[Registered under the Act for the Protection of Articles of Utility. John Warr, of Canal-street, Derby, Stove Grate Manufacturer, Proprietor.]

Fig. 5.

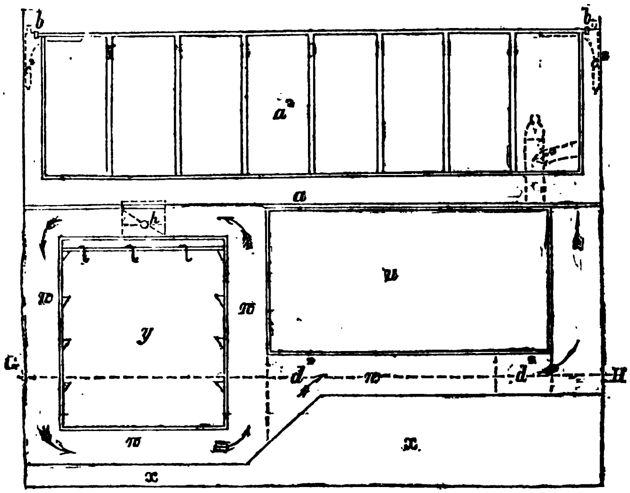


Fig. 1 of the accompany engravings exhibits a top plan of this apparatus; fig. 2, a front elevation; fig. 3, a section on the line A B, of plan, fig. 6; fig. 4, a section on the line C D, of plan, fig. 6; fig. 5, a section on the line E F, of plan, fig. 6, with elevation of plate-warmer. And, fig. 6, plan on the line G H, of section, fig. 5.

Description.

a is a top of cast-iron; the dotted line shows where the back plate or stone, a^2, stands on the top.

b, cover of the fire-chamber, which is thrown open when the stove is used as an open one, in which case a door over it into the chimney is opened to admit the smoke.

c, cover to opening, used to feed the fire and to admit a kettle.

d, cover to opening, to feed the boiler at, and to admit a steamer when there is no supply-pipe to the boiler.

e, steam pipe to conduct the steam wherever it may be required for cooking, warming a bath, &c., when there is a supply-pipe to the boiler, in which case the opening *d* is done away with.

f, oven or roasting door; f^2, the air-chamber, through which the air that enters at *g* passes warmed into the oven by the holes f^3, about 1 inch from the top.

h, upper ventilator to let out the foul air from the roaster.

i, doors of openings for cleansing the flues.

j, bars of wrought-iron to fire-chamber.

k, door of wrought-iron to fire-chamber to make it a close stove, having openings to fit the bars, thereby exposing the bars to the cold air in order to prevent them from being burned. When it is required to have an open fire, this door is thrown open behind the door of the ash-pit, as shown in fig. 3.

l, apertures to admit air on to the fire.

m, bolt to hold up the door.

n, door to ash-pit.

o, eye to the pinion and rack which move a plate for enlarging and lessening the fire-chamber.

p, tap for drawing off hot water from the boiler.

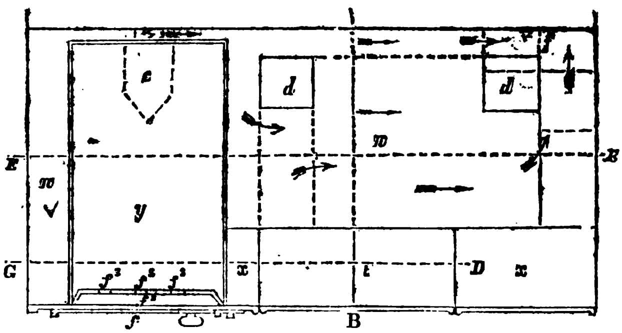
q, fire-chamber.

r, bottom bars; r^2, plate to support front of boiler.

s, rack, which carries the plate for enlarging and lessening the fire-chamber.

t, ash-pit.

Fig. 6.



u, boiler of wrought-iron, resting on the plate r^2 and pillars *d*.

v, top edge of oven, showing the commencement of

w, the flue. The arrows show the course of the flame.

x, solid brick or stone work.

y, oven or roaster of wrought-iron, showing the ledges for shelves, and a sliding rack with hooks for suspending anything to be roasted.

z, cast-iron plate to prevent the flame from burning the oven.

a^2, plate warmer of wrought-iron, when out of use, suspended by the loops *b*.

c^2, brackets placed towards the front to support the front edge of plate warmer when turned up for use; when not in use, these brackets turn back out of the way.

d^2, brick pillars to support back of boiler.

e^2, a ½ brick under the oven to divide the flame.

f^2, the exit flue is over the dotted lines marked *f*.

g^2, the exit flue of the foul air from the roaster is over the dotted lines marked *g*.

The advantages claimed for this cooking apparatus over all others are, its simplicity, requiring, as it does, the least possible skill in its management—its great economy, being able to do more work with less coal—its cleanliness—and its equal adaptability for small as for large establishments.

ON THE APPLICATION OF SUM AND DIFFERENCE LOGARITHM TABLES. PART IV.

Sir,—I am in the present paper to give a concluding example of the practical application of Matthiessen's Table, and to offer a few remarks on the comparative advantages of this table and the common tables, for purposes to which both are adapted.

The calculation of the values of benefits depending upon life contingencies has been much facilitated of late years by the introduction of tables of a peculiar form, called Commutation Tables, of which a specimen is given and described on pp. 439, &c., of your 37th volume. The specimen table referred to is in natural numbers, and in that form it is adapted to every purpose. But where a table is to be extensively used, its application will be much facilitated if the principal columns of it, at least, be also exhibited in logarithms. If the table be given in either of the two forms we can of course pass to the other by means of the common tables. This method, however, possesses the disadvantage of requiring a distinct verification of each single operation, since these are all independent of each other. But by the use of Matthiessen's table, when the logarithms of the fundamental columns are given, we can, without the intervention of a single natural number, construct a logarithmic commutation table by a series of operations, in which each depends upon that which precedes it, and which consequently require verification only at intervals. This method possesses also, as will be seen, one other important advantage. I give an example of this method as applied to the Carlisle Table of Mortality at 3 per cent.

The construction of the Commutation Table in the usual form is fully described in the paper already cited, and in the

Companion to the Almanac for 1840. It is therefore unnecessary to say more here than that each value in col. D is the product of two factors, the logarithms of which are tabulated in Mr. Jones's work, (Table 10, p. 290, and Table 8, p. 103.) The logarithms of these values, therefore, are easily found. Also, the relation of col. N to col. D is such, that any N is equal to the sum of the D and N corresponding to the next higher age. So that we have the following general equation:—

$$N(x) = N(x+1) + D(x+1)$$

Consequently, if the logarithm of any N be known, those of all the D's being given, Matthiessen's table will furnish, by successive and dependent steps, the logarithms of the N's for all the younger ages. Now the logarithm of the N corresponding to the next to the oldest age in the table (in this case 103) is known, being equal to log D(104). Setting out from age 103, therefore, the required logarithms may be found by either of the modes of operation which follow:*—

Example 3.

Logarithms of Col. N, Carlisle, 3 per cent.

Formulæ 2 and 1.

log D(103)	1548 871	6649286	log N(103)	
colog a(103)	4899 585	6116791		C
		442		
,, D(102)	3895 731	2766519	log N(102)	
colog a(102)	1129 212	3611384		C
		120		
,, D(101)	5485 383	6378023	log N(101)	
,, a(101)	0892 640	2586712		B
	360	162		
,, D(100)	6705 200	8964897	log N(100)	
,, a(100)	2269 697	2025679		B
	303	113		
,, D(99)	7705 074	0990689	log N(99)	
,, a(99)	3285 615	1670943		B
	385	123		
,, D(98)	8880 800	2661755	log N(98)	
,, a(98)	3780 955	1518897		B
	045	13		
,, D(97)	0100 617	4180665	log N(97)	
,, a(97)	4080 048	1432494		B
	952	267		
,, D(96)	1293 542	5613426	log N(96)	
,, a(96)	4319 884	1366661		B
	116	32		
,, D(95)	2575 849	6980119	log N(95)	
,, a(95)	4404 270	1343876		B
	730	194		
,, D(94)	3953 609	8324189	log N(94)	
,, a(94)	4370 580	1352951		B
	420	112		
,, D(93)	5385 319	9677252	log N(93)	
,, a(93)	4291 933	1374238		B
	067	18		
,, D(92)	6940 366	1051508	log N(92)	
,, a(92)	4111 142	1423806		B
	858	239		
,, D(91)	8530 018	2475553	log N(91)	

Formulæ 1 and 2.

log N(103)	6649286		
,, D(103)	1548871	4899,585	colog a(103)
B	1217547	415	
	100		
log N(102)	2766518		
,, D(102)	3895731	1129,213	,, a(102)
B	2481949	787	
	343		
log N(101)	6378023		
,, D(101)	5485383	0892,640	log a(101)
C	3479161		
	353		
log N(100)	8964897		
,, D(100)	6705200	2259,697	,, a(100)
C	4285052		
	436		
log N(99)	0990688		
,, D(99)	7705074	3285,614	,, a(99)
C	4956263		
	418		
log N(98)	2661755		
,, D(98)	8880800	3780,955	,, a(98)
C	5299192		
	673		
log N(97)	4180665		
,, D(97)	0100617	4080,048	,, a(97)
C	5512775		
	35		
log N(96)	5613427		
,, D(96)	1293542	4319,885	,, a(96)
C	5685931		
	646		
log N(95)	6980119		

* The merit of devising the very commodious form of the operation on the left is due to Mr. Woolgar. The other was devised by myself.

A very brief description of the operations will suffice. I take that on the left first. Log D(103) is first set down, and then on every third following line the succeeding logs D in order. Opposite log D(103) is set down log D(104), that is, log N(103). Formula (2), p. 422, vol. xl., is now applied.

Of the two logs, D(103) and N(103), the former is the greater.* It therefore takes the place of log a in the formula, which thus becomes,

$$\text{If } \log D(103) - \log N(103) = A \therefore \log[D(103) + N(103)] \text{ or } \log N(102) = \log N(103) + C.$$

Subtract, therefore, sideways, as they stand, log N(103) from log D(103), and set down the difference 4899585 under the latter. This is the argument for A. Entering A with 4899, the C corresponding is 6116791, and the pro. parts for 585 are 442. Writing these under log N(103), and adding the three lines, the sum is 2766519=log N(102). The operation is precisely similar for log N(101). This logarithm is, however, greater than the corresponding log D. The operation, therefore, now changes to that of formula (1). Making the requisite substitutions in this formula, we have,

$$\text{If } \log N(101) - \log D(101) = A \therefore \log N(100) = \log N(101) + B.$$

We therefore now subtract log D from log N, use the difference for the argument in A, and add the corresponding B to log N. Thus for log N(100) subtract 5485, &c., from 6378, &c., and use the difference 0892640 as the argument in A. The B corresponding to 0893 in A is 2586712, and the pro. parts for 360 (that is, for 1000−640) are 162. The addition of the three lines gives log N(100). The same operation serves for all the remaining values of log N.

For the form of calculation on the right, log N(103) is first set down, and immediately under it log D(103). The succeeding logs D are then set down on every fourth following line. We commence with formula (1). Adapted to this case it is,

$$\text{If } \log D(103) - \log N(103) = A \therefore \log [D(103) + N(103)] \text{ or } \log N(102) = \log D(103) + B.$$

Subtract, therefore, as they stand, log N(103) from log D(103), and place the difference to the right. Entering A with 4900, we find for B 1217547, and the pro. parts for (1000−585=)415, 100. Adding these to log D(103), we have log N(102). Here also the operation changes, when log N(101) is found, in consequence of the change in the relative magnitudes of log D and log N, and formula (2) must be used, which, adapted to this case, is,

$$\text{If } \log N(101) - \log D(101) = A \therefore \log N(100) = \log D(100) + C.$$

Log D, therefore, has now to be subtracted from log N, and the difference used as the argument in A. The corresponding C added to log D gives the next log N, and so the operation will continue till all the logs N have been found.

The natural numbers corresponding to these logs N will be the N's in Mr. Jones's table (Annuities, p. 292), true to seven places.

The leading property of col. N in the Commutation Table is this:—Any N divided by its corresponding D gives the value of an annuity of £1 on a life whose age is the number of years opposite which these quantities are placed; and the analogous property of the table in the logarithmic form is, that the excess of any log N over the corresponding log D is the logarithm of the annuity at that age. Now in each of the operations exhibited above, after the first two terms, it is this excess which is used as the argument for finding the next succeeding term. And thus the slight labour of the subtractions requisite in the application of this method are amply compensated by the attainment of such valuable results. The log annuities found in this way may be compared with those found

* Of two logarithms having negative indices, that is to be reckoned the less which is the more remote from log 1 or 0; so that, if their indices be different, that logarithm is the less, whose index has the greater numerical value.

by the more usual formula in example 2, last paper.

From the logarithms of col. C those of col. M may be found, by a process similar to that above shown; and from the logarithms of cols. N and M thus found, those of cols. S and R may, in like manner, be determined.

In regard to the examples given, I must add that there is no *by* calculation. Every figure made use of is exhibited.

Now as to the comparative advantages of Matthiessen's Table and the common tables for such calculations, I shall take example 2, last paper, for the purpose of comparison. By the common tables the same general formula would be used, viz.,

$$\log a(x) = \log vp(x) + \log[a(x+1)+1];$$

and the mode of applying it would closely resemble the operation by col. C. With this operation I shall therefore more particularly compare it.

I give the calculation of log a (100) by the common method.

$$\begin{array}{rll} a\,(101) = 1{\cdot}228186 & \log & 0892640 \\ \hline vp(100) & ,, & 8780183 \\ a(101)+1 = 2{\cdot}228186 & ,, & \left\{\begin{array}{r}3479347\\168\end{array}\right. \\ \hline a(100) & ,, & 2259698 \end{array}$$

A chief peculiarity of this method, as distinguished from Matthiessen's is, that here two tabular conversions are necessary, instead of one. Log $a(101)$ being supposed to have been found by the preceding operation, the *number* $a(101)$ has first to be taken out, and then the *logarithm* of $a(101)+1$. This, as has been already seen (p. 422, last vol.), introduces a new source of error, besides materially adding to the labour. It is true that the additional result thus found, viz. a, is a valuable one, and one that, if it has to be found by Matthiessen's method, will require another conversion; and thus place both methods so far upon an equality. Still the advantage rests with the latter method. For, first, the two conversions required by the old method being of different kinds, the table having to be used alternately inversely and directly, I believe those most accustomed to the use of tables will admit that this mixing of operations has a tendency to produce confusion and error. Matthiessen's table, on the other hand, is used directly throughout, and the finding of the whole series of logs a is not interrupted by the occurrence of a single inverse operation. The subsequent finding of the natural numbers corresponding to these logarithms, which, of course, is done by the common tables, is equally free from the objectionable mixing of operations. Secondly,—another circumstance strongly bearing upon the comparative merits of the two methods is, that in the first there is a continual and wearisome turning of the leaves of the table *both backwards and forwards*, while in the other we proceed gradually, with few exceptions, from the beginning of the table towards the end.* This is of more importance than persons not much accustomed to the use of tables can form any idea of. But, thirdly and finally, as all the purposes of a table of annuities can be served by the logarithmic values, the table becomes immediately available where these values are found; and the taking out of the natural numbers, if this is to be done at all, may be reserved for future convenience.†

I conceive the superior adaptation of Matthiessen's table to calculations of the kind under consideration has been now sufficiently shown. There are others to which, if space permitted, an equally advantageous application might be indicated. I hope, however, that what I have written may not be without its use in directing attention to this table, being fully persuaded that to be highly appreciated and frequently used, it is only necessary that it should be better known. I trust also that ere long an English edition of the table will supply those conveniences in paper and typography which the original does not possess. In the meantime, I may add, the present impression may be procured, for about ten shillings, through the usual channels in town.

I am, Sir, yours respectfully,

G.

Hermes-street, Pentonville,
June 27, 1844.

* I give here, *in their order*, the pages of Hutton's Tables that have to be consulted in finding log $a(100)$ and the three following values:—10, 30, 19, 39, 28, 48, 33, 53. The pages of Matthiessen, for the same values, are 9, 23, 33, 38; and when all the logs a are found, the pages of Hutton to be consulted for the natural numbers will be 10, 19, 28, 33.

† See also on this point Mr. Woollgar's Note, appended to last paper.

Numerical Relation of Quantities in Gauss's or Matthiessen's Table.

Nat. No.	A	B	C	Δ B	Δ C	ΔB : ΔC
1	0·0000000,000	0·3010300,	0·3010300,	500,	500,	1:1
10	1·0000000,	0·0413927,	1·0413927,	90,909	909,091	1:10
100	2·0000000,	0·0043214,	2·0043214,	9,901	990,099	1:100
1000	3·0000000,	0·0004340,775	3·0004340,775	,999	999,001	1:1000
10000	4·0000000,	0·0000434,273	4·0000434,273	,099 +	999,900	1:10000
9	0·9542425,	0·0457575,	1·0000000,	100,	900,	1:9
99	1·9956352,	0·0043648,	2·0000000,	10,	990,	1:99
999	2·9995654,882	0·0004345,118	3·0000000,	1,	999,	1:999
9999	3·9999565,684	0·0000434,316	4·0000000,	,1	999,9	1:9999

In both series of these quantities, the effective figures of the value of B evidently approximate to the modulus of the common system, viz. · 43429448, which is the limit of either of them indefinitely continued.

Lewes, July 1, 1844. J. W. W.

ON THE POSSIBILITY OF AUGMENTING ARTIFICIALLY THE SIZE OF DIAMONDS.

Sir,—It is now many years since the ingenious experiments of Messrs. Allen and Pepys established by direct synthesis the identity of the molecular par- particles, or, if you will, ultimate atoms of charcoal and the diamond. All attempts have, however, hitherto failed by analysis, or any other means, to obtain such a crystallized arrangement of the particles of carbon, as would enable their aggregrate to transmit the rays of light freely, so as to present the *diaphanous* character and appearance of the diamond, instead of the opacity and black colour of the charcoal, which shows that the arrangement of its particles offers an obstruction to the free passage of the incident rays.

In a *scientific* point of view this is, and must continue to be felt as a *desideratum*, so long as we shall be unable to exhibit carbon to the senses, under the same external characters as those which so remarkably distinguish the diamond.

It has occurred to me, however, that it might be possible to supply this want in a commercial and economical point of view.

It is well known to chemists, that the process of crystallization is aided and urged on by introducing a crystal of the substance to be crystallized as a *nucleus*, round which the crystallizable particles shall arrange themselves, so as to expedite the formation of the crystal while it adds to its bulk.

Now taking this into consideration, I have thought this principle might be applied so as to *increase* the size of diamonds, by placing a diamond, surrounded with charcoal, reduced to the minutest powder in the current of the electric or galvanic fluid, or subjecting them to the powerful agency of electro-magnetism. Under these circumstances, might we not hope to see the minute particles of the charcoal arranging themselves in crystallizing symmetry round the nucleus diamond?

I would recommend any such experiments to be made *in vacuo* to prevent the risk of the charcoal or diamond becoming oxidized, so as to form carbonous or carbonic acid. It might be well also to try the slow, but powerful agency of the galvanic energy evolved by means of a very diluted acid, or even water only, as in the celebrated experiments of Mr. Crosse. In this way we are more likely to imitate the *modus operandi* generally employed by Nature in her great laboratories.

Should the experiments be crowned with success it is easy to perceive how valuable the results would be, as we could thus form diamonds of any magnitude, whose price in the market would increase in the cubic ratio of the number of carats they would weigh. Conceiving that those who have the advantages of galvanic or electric apparatus would do well to bring this suggestion to the test of experiment,

I offer it to their attention through the medium of your widely-circulated Magazine.

I am, Sir, yours truly,

WILLIAM S. V. SANKEY, M. A.

EXTRAORDINARY MEMBER OF THE MEDICAL SOCIETY OF EDINBURGH, AND CORRESPONDING MEMBER OF THE SOCIETY FOR MUTUAL INSTRUCTION OF PARIS.

DEPOSITS IN STEAM BOILERS.

Sir,—Mr. Hall's remarks at page 366 of your June number, on my letter of the 18th March, require a few words in reply, which I must beg the favour of your inserting.

He says, "I should have done well not to have supposed the feed water to contain sulphate of lime, as the incrustation in land boilers fed with fresh water is invariably *carbonate* of lime;* so that we have only to guard against the carbonate, and not the sulphate of lime." So far, Mr. Hall admits he was wrong in asserting that muriate of soda decomposes the sulphate of lime; however, without his admission, the result in the case of marine boilers is a sufficient proof that no such action takes place; he is also equally incorrect in saying that it decomposes the *carbonate*, for in no instance does it occur; a proof of that fact would be a great and valuable discovery.

Mr. Hall asks, "whether I have never *dreamt* that the sulphate of soda and the muriate of lime have dwelt together for ages, without mutually decomposing one another?" To this question, I beg to say, that I do not believe such to be an ascertained fact, and with all due deference to Dr. Murray's statements, have reason to doubt it; even in a very dilute solution, much more when concentrated, as in a steam-boiler. The most esteemed analyses of sea water are those of Dr. Schweitzer from the English Channel, and M. Laurens from the Mediterranean, which I subjoin.

	English Channel.		Mediterranean.
Water	964·74372		959·26
Chloride of sodium	27·05948		27·22
——— potassium	0·76552		0·01
——— magnesium	3·66658		6·14
Bromide of magnesium	0·02929		"
Sulphate of magnesia	2·29578		7·02
——— lime	1·40662		0·15
Carbonate of lime	0·03301	and magnesia	0.20
	1000·00000		100·00

Neither of these analyses give sulphate of soda, or muriate of lime, *as such combinations*, but plenty of the elements to form them were they isolated. The elements of some of the salts in sea water, vary in their combinations before and after evaporation; hence the reason of sulphate of soda occurring in the mother liquor of brine pits.

Mr. Hall complains of my being unfair in not quoting correctly. At page 170, he says: "The chemical action of the salt on the lime is simply as follows:—the salt (muriate of soda) mixes with the water, forming a new combination with the lime, either in the state of a carbonate or a sulphate, forming, in the first case, *muriate* of lime and carbonate of soda, and in the second, *muriate* of lime and sulphate of soda;" and at page 366, he says "he likewise makes me say, that the muriate of soda decomposes the sulphate and carbonate of lime, rendering them soluble as *muriates*." Wherein the latter differs from the former, except in being more concise, I am at a loss to discover.

I am, Sir, yours truly,

F. HAM.

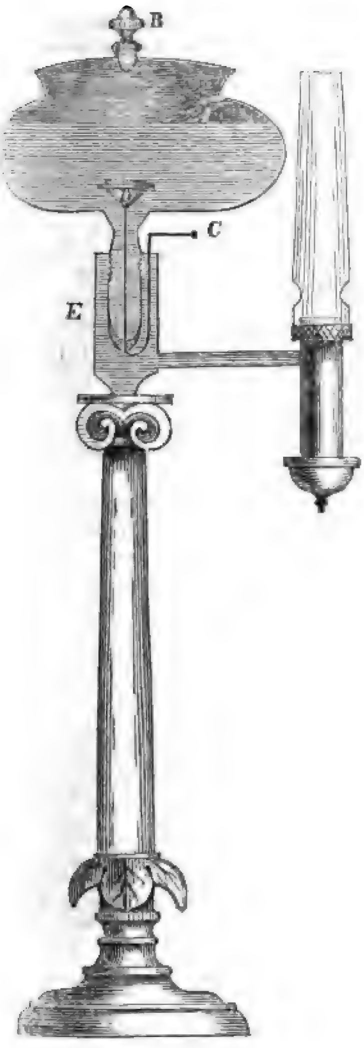
Norwich, July 11, 1844.

IMPROVED FOUNTAIN LAMP.

Sir,—You will oblige me very much by informing me where the Vesta Lamp, described by Dr. Ure, in page 267 of your Magazine, may be purchased. Is the Vesta Lamp alluded to by the doctor the same as the one patented by Smith,

* In my practice I have found the *sulphate* of lime occurring quite as frequently as the carbonate; this depends entirely on the strata through which the water infiltrates.

and described in page 177 of your Journal?*



I am in the habit of using a lamp in which I burn common lamp oil, purchased in Dublin at 4*s.* 6*d.* per gallon. I made what I consider some improvements in the ordinary Argand fountain lamp, a description of which I send you. In unscrewing the common Argand lamp to replenish it with oil, I found it both inconvenient and liable to spill the oil; besides, the change in the temperature of the apartment affects the air in the fountain, causing it to expand and contract, so that the oil, when the air expands, flows from the fountain and overflows the lamp, and soils everything near it. Now, I replenish my lamp with oil without unscrewing the fountain, and no matter how the temperature of the apartment varies, the fountain still retains the oil. A is a section of the fountain, in the top of which there is a hole, in which is screwed a plug B, having a circular leathern collar between the shoulder of the plug and the brass tube, into which the plug screws, thereby making an air-tight joint. C is a bent brass wire, about as thick as a quill, which descends into the reservoir E, and passes up through the shank of the fountain and terminates in the conical valve D. By pressing down the wire C, the valve D is drawn into its seat, and the fountain becomes completely stanch. Unscrew the plug B, and pour in the oil, taking care to screw home the plug B, before the valve D is opened.

If the fountain A were of china, or some very transparent substance, it would be of great advantage, for then it would be seen when a supply of oil was required.

Yours,

T. Langan.

Ardoath, County Meath, May 21, 1844.

* The Vesta Lamp is sold by Young, No. 64, Queen-street, Cheapside. Smith's, which is of a different construction, may be had of the inventor, No. 281, Strand.

FOREIGN SCIENCE.

New Steam Pressure Gauge.

M. Collandeau has recently presented to the Academy of Sciences, through M. Arago, a pressure gauge for steam boilers, &c., using high pressure, upon a principle totally different from the manometer. It is well known that great practical difficulties exist in the formation of accurate manometers acting upon the principle of Marriott's law, and that when made they are liable to certain errors of principle and of construction difficult or impossible to eliminate. Collandeau's instrument is intended to remove this. It consists in fact of a sort of thermometer (so far as form goes),—the tube of glass, and the bulb, which is

flattened, of a flexible and elastic metal, (such as palladium, probably) filled with a fluid. The metallic scale contains certain arrangements, not yet fully described, to compensate the effects of expansion by change of temperature of the fluid and of the scale, so that the pressure of the medium in which the bulb is immersed remaining the same, the height of the fluid column and the tube shall be constant, no matter how the temperature around the instrument may vary, within certain limits. Now when the flexible bulb is placed in a steam boiler, it is obvious that the column of fluid in the tube will rise or fall, according as the pressure upon the bulb compresses it or permits it to regain its former volume, and thus indicate the variations of steam pressure. The accuracy and value of the instrument, of course, wholly depends upon the degree of accuracy possessed by the contrivances for compensation as to temperature.

Explosion of a Mass of Obsidian.

M. Damour, in January last, read to the Academy an account of a large spheroidal mass of obsidian from India, which burst into fragments, that flew about like those of a bomb, while in the act of being sawn through by a lapidary. He supposes the particles of the mass to have been suddenly cooled by being projected through the air from a volcano, and thus to have been in a state of violent tension; like the Prince Rupert drops, which are formed by the sudden cooling of bottle glass, when dropped in a melted state into water, and which, while they will bear a blow with a hammer on their thick ends without fracture, fly instantly to pieces with explosion, when a bit of their tails is broken off.

Mr. Mallet, in a paper read to the Geological Society of Dublin, had predicted the probability of such volcanic bombs, or gigantic Rupert drops, being found; but probably without any idea that his views would so soon receive a verification.

Steam-engine Jacketing.

A very able paper has been published at Paris by M. Combes, mining engineer, and the distinguished author of the most important mathematical investigations ever made upon the subject of the ventilation of mines, upon the value and use of jacketing in steam-engines. Although this practice has long been carried to the highest perfection in Cornwall, it remained still a question whether the non-conducting jacket of this locality, or the steam jacket of Watt, or both combined, was the most valuable arrangement, and the amount of utility or economy of each was still undecided. These questions Mr. Combes has considered, and by experiments tabulated upon the same engine in the respective conditions of jacketing has arrived at precise and important results.

The paper does not admit of abstract, its chief value lying in its tables of experimental results.

Cultivation of Opium in Algeria.

The French are at present much occupied with the project of cultivating opium extensively in Algeria,—one step in their march in this direction to the intended absorption of our Indian possessions !

Ruolz's Substitute for White Lead.

M. Ruolz, whose processes of zinking iron by the humid methods have been noticed with approbation, as suited to the protection of all articles of iron which are not exposed to water, has recently proposed and brought into use with economy and advantage (at least in France) a substitute for ceruse or white lead, namely, oxide of antimony, which he obtains by his new process of desulphuration of the native sulphurets of antimony, which abound in some parts of France. It would seem very probable that, by proper treatment, a valuable substitute for white lead, which so rapidly gets discoloured by the sulphuretted hydrogen in the air of large cities, might be found in the blende or black jack, which exists in such plenty in the Isle of Man and other parts of Great Britain.

Rolling Friction.

M. Pambour has been reinvestigating the important subject in engineering data of the rolling friction of wheel carriages upon railways. Wood estimated this at about $\frac{1}{1000}$ of the weight; but in this he took no account of the resistance of the air. Pambour has done so, and has presented to the Institute the results of his experiments and deductions, which appear to modify considerably the mea-

sures deduced by Wood, and up to this time implicitly adopted by engineers.

Wax.

Dumas has engaged in an extensive chemical examination of all the known species of wax. M. Lesvy has examined in his laboratory with much care the properties, &c., of the vegetable wax from China, which is produced by the rhus succedaneum, a species of schumach. Its composition is expressed by the formula $C_{72}\ H_{72}\ O_4$. This wax is of a brilliant white colour, crystallised, and like spermaceti. Its melting point is as high as 82½° centegrade (116⅓° Fahr.), which will render this wax of the highest commercial importance as a substance for the formation of fine candles in combination with the fats which melt at lower temperatures.

Killing Whales by Prussic Acid.

It is known to most persons that, besides the established and orthodox mode of killing whales usually adopted in the polar fisheries, several others have been devised by ingenious persons, and some of these have been tried with indifferent success. Such was the case with the plan for slaughtering the leviathans by firing Congreve rockets into their obese bodies, which certainly killed the animal —when they hit him; but left the carcase valueless. But amongst all the schemes, perhaps, the most singular, as well as novel, is that which a Frenchman of German extraction, M. Ackermann, has lately proposed. It consists in killing the whale by shooting a dose of Prussic acid into him, contained in the extremity of a suitably formed harpoon. It seems likely that the whale fishers would be often the worse of their own weapons.

New Plant from China.

The French Missionaries in China have sent home seeds of a plant used in Tché-Kiang, and considered of great value. It is one of the *leguminosæ*, supposed to be closely allied to the *dolichos*, or *phaseolus* genera. It produces edible seed vessels and seeds like the French bean; and the long twining stalks of the plant form, when treated like hemp, a most valuable textile fibre. This may be worthy the notice of British speculators in our new Chinese possessions.

R. M.

MR. WOODHEAD'S THEORY OF THE IDENTITY OF LIGHT AND AIR. (SEE MECHANICS' MAGAZINE, VOL. XL. P. 354.)

Sir,—The "Essay on Light," by Mr. G. Woodhead, published in your Number for the 1st of June, is so much at variance with all received doctrines, that it would, if true, produce a revolution in science.

Your correspondent assumes that he has fully demonstrated the truth of his position—that his facts are irresistible, his conclusions inevitable. A little examination, however, will show that he may possibly have deceived himself.

His mode of experimenting is as follows:—He places sealing wax, iron, wood, black cloth, and some other substances, under water, in the focus of a burning lens; he finds that air bubbles are disengaged in great abundance, apparently from the substances themselves, and not being able to account for the presence of all the air, infers that it must have entered the substances as light, and that consequently *light is air!*

Since *heat*, as well as light, must have been present at the focus of the lens, your correspondent might have argued with equal reason, that *heat* is also *air*.

All porous substances imbibe air in a more or less degree; that this air should have been expanded by the *heat* of the lens, and disengaged in the form of bubbles, was surely what might have been expected. Indeed air would be liberated from the water itself by a moderate elevation of temperature.

But Mr. Woodhead took the precaution of expelling the air from the water by boiling; and the long time that the bubbles continued to rise without diminution, seemed to him to preclude the possibility that the air could have previously existed in the substances.

Supposing the water to have been effectually exhausted of its air, Mr. Woodhead may have allowed it an opportunity of absorbing a fresh supply, which it would very soon do. If he took care to prevent this, it is still possible that the substances exposed to the lens might be capable of yielding more air than he was aware of their containing. It has been stated on very high authority that a cubic inch of charcoal must have a surface of a hundred square feet at the lowest computation; and that the same substance has the property of

absorbing gas to the extent of many times its volume, ten, twenty, or even, as in the case of ammoniacal gas, or muriatic acid gas, eighty or ninety fold.* So that it appears not impossible that a porous substance, in the predicament described by Mr. Woodhead, might continue to evolve gas for very many hours, perhaps for a whole day, without any sensible diminution.

If, however, this could not be, (of which I am by no means sure,) it would become, perhaps, a somewhat difficult question, whence all the air could have been supplied; but it would not follow as a matter of course that light is necessarily air.

Light may be powerfully increased without the assistance of air; as when any fine dust is thrown into burning hydrogen, or when metallic wires are rendered luminous in dilute sulphuric acid by a voltaic current, or when such a current is transmitted through a fine platinum wire connecting the poles of a battery.

The intense light produced by charcoal points attached to the poles of a battery can even be exhibited *in vacuo;* and many substances which will not burn at all in common air, burn vividly in chlorine.

If we will only grant light to be air, it seems to be of little consequence what *kind* of air it is. It may be "atmospheric air," for this, he says, "will burn and become light;" or it may be "common coal gas," for he tells us that "gas is air," and will do the same.

Chemists, perhaps, will smile when they hear that "atmospheric air *will burn*." But let that pass. That "gas is air"† is true only in the same sense in which it is true that chalk is cheese, viz., not at all. However as chalk resembles cheese, inasmuch as they are both solids, so gas, like air, exists in the state of vapour; and this, I presume, is all that your correspondent could have intended. But then I must have leave to tell him that every substance in nature, so far as either he or I know, may become so far air as to exist in the state of vapour. So that to tell us "light is air," is to give us a very vague apprehension of light.

If your correspondent meant to teach that light is merely a result of material action and reaction, he would have found no opponent in me. But then this would have been no new discovery of his, Mr. Alfred Smee having taught the same, and having given many cogent reasons for that doctrine in his masterly treatise "On the Sources of Physical Science." Mr. Woodhead, indeed, designates light to be "not a distinct essence, nor a separate element; but matter *in a state of action*," or "air *in a state of radiation*." Though I know not how he would reconcile this with what he says a few lines after, viz., "light may be *caught and examined*, when it is found to be *quiescent air!*" He also says, "it may be confidently asserted (for in this paper it will be proved) that light is a *ponderable substance*."*

If light be a ponderable substance, I ask *what* substance? If it be action, *what* action? To call this action *radiation* is to put us off with a word; for what is radiation? All this is, in fact, to say that light is light.

I believe your correspondent to have been sincere in his conviction that he had hit upon a new truth, and the promptitude with which he published it deserves the thanks of your readers. His intention was doubtless good. There was ingenuity in the experiment, and the result of it, to say the least, was curious. It may even be the means of extending our knowledge of the absorption of gases, though it be inapplicable in the case of light, just as the wings of the poet, though they failed him in the air, supported him upon the water.†

I am, Sir,
Your obedient servant,
THOS. D. EATON.

Norwich, July 15.

* See Liebig's Familiar Letters on Chemistry.

† The reader will please to remember that, in Mr. Woodhead's letter, by gas is meant coal gas; and by air, atmospheric air.

* The insuperable objections to the doctrine of light being a ponderable substance are noticed by most writers who have supported the undulatory theory.

† This alludes to the poet in Rasselas.

PRINCE PIERRE BAGRATION'S NEW VOLTAIC BATTERY.

[From Notes by Professor Jacobi, read before the Petersburgh Academy of Sciences, Feb. 22, 1844, as translated in Mr. Walker's Electrical Magazine for July.]

The application of the voltaic battery having lately received a great development, I think it my duty to the Academy to an-

nounce an improvement, which reduces this valuable apparatus to a state of great simplicity, and by which means it can be rendered very useful for practical purposes. Everybody is aware that nothing is more easy than to obtain a galvanic current. Take a piece of zink and one of copper, united with a wire, place them in some acid or saline water, and you will produce that remarkable current, which is rendered evident by its chemical as well as by its calorific and magnetic effects. But we know also the many difficulties which have to be surmounted, if we wish to obtain by this means effects, the action of which is sustained and constant. The obstacles arising from the decrease of the force, which begins to be manifested from the moment the current is formed, have, for nearly half a century, checked the progress of the science, and hindered those practical applications, the possibility of which was plainly foreseen. It is to Mr. Daniell that we owe the discovery of a constant battery,—an admirable discovery, and one which has given to galvanism an entirely new impulse. I shall not speak now of the numerous changes and improvements which have since been applied to these batteries; I shall only observe, that with the great advantages that belong to all these apparatus, there are also several inconveniences, of which the following are the most serious:

The employment of two liquids separated one from the other by a porous partition, renders the manipulation of this apparatus the more inconvenient, as the number of the elements is more considerable. During the action of the battery, and still more when the action must be interrupted for some time, the effects of endosmose present themselves, and occasion the mixture of the two liquids through the diaphragm. The liquids must be constantly kept at a certain degree of concentration or dilution, which is especially difficult to obtain when nitric acid is used. The pores of the diaphragm also are in the end often filled with crystals, which hinder the circulation of the current and necessitate a change, or repeated washing of these porous bags.

All those who make a constant use of batteries would undoubtedly prefer employing elements less energetic, but larger and more numerous, if by that means it were possible to obtain a constant battery, one, the manipulation of which was more simple; or, more properly speaking, a battery which, when once constructed, should require no further manipulation.

The following are the means by which this end can be perfectly obtained:—

Take a flower-pot, or any other vessel impervious to water, which you will fill with earth, saturated with a very concentrated solution of hydro-chlorate of ammonium or sal ammoniac; you then place in it, at a certain distance from each other, a plate of copper and one of zink, and you have a voltaic pair, which in a short time becomes perfectly constant in its action, and which can be kept in this state for months, and to all appearance even for years, provided that care is taken to moisten the soil occasionally, and to renew the zink plate when necessary, which, as we well know, begins to dissolve as soon as the circuit is closed, which, however, takes place very feebly, or in proportion to the force of the current that is produced.

Before placing the copper plate in the earth, it is well to plunge it, for some minutes, in a solution of sal ammoniac, and then allow it to dry, until a green film is formed on its surface. This operation greatly facilitates the effect of the battery; and it even seems to me that, in this respect, brass would be perhaps preferable to copper.

The theory of this battery cannot yet be established in an exact and precise manner; but it seems that the constancy of its action is due to this,—that the hydrogen, which would be developed at the surface of the copper, is employed to reduce the double salt of that metal, which is formed by the chemical action of the sal ammoniac on the copper; so that the constancy of its action may be considered as the expression of a kind of equilibrium between this chemical action and the galvanic reaction. The earth, it appears, only acts as a very porous diaphragm, which prevents the salt of zink from being reduced on the surface of the copper by the action of the galvanic current; and, at the same time, it prevents the possibility of the zink having any chemical reaction on the salt of copper. We may add that it is not altogether impossible that the earth, like every porous body, absorbs the bubbles of hydrogen, which in ordinary batteries cover the copper plate, and, as we know, cause a diminution in electro-motive force.

It is advisable not to place the two plates too near to each other, but to give some thickness to the bed of earth intervening between them. In like manner the plates ought not to be too small, because the earth opposes a great resistance to the passage of the current. I have not yet found time to get an exact numerical value of the constants of these batteries, nor to enter more deeply into the details of this combination, which, it is to be hoped, will yet receive many improvements, both by the zeal of the inventor, and in consequence of its more general use.

As great efforts are being everywhere made

to advance the application of galvanism, the publication of this invention ought to be no longer delayed. This battery, as we have already mentioned, is susceptible of many applications; and its utility is principally discovered in those cases, in which very energetic effects are less an object than a constant and prolonged action, as, for example, in the reduction of metals, in chemical decompositions, &c. I do not see what inconvenience there could be in placing in a cellar or granary some hundreds of these vessels or flower-pots, which might furnish a perpetual source of electricity, to be used at pleasure. I have myself placed in my house a battery of this kind, consisting of twenty-four elements, which has been in action for about six weeks, without there having been the least occasion during all this time to make the slightest alteration. It is needless to add that the vessels ought to be very well insulated, especially when we employ a series of many elements. As there is a great resistance in the pile itself, the loss occurring from defective insulation would become more sensible than in Daniell's batteries and others.

The invention of this battery is due to the Prince Pierre Bagration, lieutenant to the horse-pioneers of the guard, and aide-de-camp to General Vitoftoff, chief of the engineers of the guard.

I think it necessary to add one more remark. Some time ago, I placed in the earth, to the level of the water, two very large plates of zink and copper, and by this means obtained a pair with a power, which was absolutely constant, and sufficiently energetic to decompose several metallic solutions, and, among others, that which is employed in gilding by the galvanic way. But this simple means could not be applied, when we desire to produce a greater electro-motive force,—a force, which, as we all know, cannot be obtained but by the combination of several pairs in series. Although the earth is, in both cases, made use of, it is yet evident that the process which I had employed must not be confounded with Prince Bagration's pile, which is susceptible of much greater energy.

EASTER DAY, 1845.

[The grave mistake which forms the subject of the following notice by Professor De Morgan, in the *Athenæum* of Saturday last, cannot be made too extensively or too speedily known.]

In an article which I have prepared for the next number of the "Companion to the Almanac," I have discussed the reasons why Easter Day will next year fall, in apparent defiance of the Act of Parliament, upon the very day of the full moon. But as an accidental application which I have received (and I know that the superintendant of the Nautical Almanac has received another from a different quarter) makes me think that the computers of almanacs will be puzzled, and that the useless discussion of 1818 (when the discrepancy last occurred) will be revived, unless some one will forthwith state the reason of the difficulty, I request that you will publish some of the conclusions of the paper to which I refer, which will in due time appear in the work cited. The rule adopted in this country for finding Easter is that of the Roman Catholic Church, as established at what is called the reformation of the Calendar by Pope Gregory XIII. in 1582. The authority for this rule is contained in the papal brief of March 1st, 1582, in which reference is made, for all explanations, to the then forthcoming work of the Jesuit Clavius, to whom both the adjustment and explanation of the Calendar had been intrusted. The British Parliament, in adopting the *rule* of Clavius, made two mistakes in the *explanation* of that rule. Their explanation is, that Easter Sunday is the Sunday after the full moon, which comes on or next after the 21st of March, and that if the full moon fall on a Sunday, Easter Sunday is the next Sunday.

The two mistakes are as follows:—

1. Instead of "full moon," they should have said "fourteenth day of the moon, the day of new moon being reckoned as the first." That Easter, as well as the Passover, was always regulated, not by the full moon, but by the fourteenth day of the moon, is of the utmost historical notoriety. And Clavius says that "none but a few who fancy themselves sharpsighted ever imagined that the fourteenth of the moon and the full moon were the same in the church of God."

2. Instead of the "moon" of the heavens, they ought to have said the "moon of the calendar," which is a very different thing. The moon of the calendar is not even a mean, or uniformly moving moon, to which astronomers refer the real moon; but differs from it intentionally and avowedly, by two classes of arbitrary alterations, the first class intended for simplicity of calculation, the second for avoiding the possibility of the Christian Easter falling on the actual day of the Jewish Passover.

In the year 1845, the fourteenth day of the *calendar moon* falls on Saturday the 22nd of March, whence Easter is rightly made to be Sunday the 23rd, according to the law both of the Roman and English churches, though the English statute does not well explain its own method. With regard to

this country, it should be noticed that this statute enacts that Easter shall be kept by the "calendar, tables, and rules" annexed to the act: and these agree with Clavius.

Of course any one is at liberty, as many did in 1818, to think that the statute should be altered; and certainly, it would be worth while to avoid misconception by repealing the faulty definition, and substituting a better one, in the Prayer-books of the Established Church. But if any one should wish to advocate the repeal of the rules, and the construction of new ones agreeable to the existing definition, and astronomically true, he will perhaps pause when he finds that his own system would *sometimes* cause it to happen that St. Paul's Cathedral must keep Easter a week after Westminster Abbey, and would very frequently make a week's difference between the festivals of the colonies and the mother country. I remain, Sir, yours faithfully,

A. De Morgan.

University College, London,
July 11, 1844.

SCHOTLAENDER'S PATENT IMPROVEMENTS IN THE DEPOSITION OF METALS.

[Patent granted December 8, 1843; Specification enrolled June 8, 1844.]

These improvements consist—Firstly, in the electric deposition of metals upon various felted and other fabrics, such as linen, leather, glass, earthenware, &c., not being themselves conductors of electricity, by driving the deposited metal on to, or into, the surfaces of the fabrics by simple contact with suitable conducting surfaces; and, secondly, in certain improved forms and arrangements of apparatus for effecting the deposition of metals from their solutions by electric agency.

To deposit a coating of copper on linen or such like fabric—a plate of copper of the proper dimensions is rubbed over on one side with plumbago to prevent the adhesion of the deposited material, and the other side of the plate is rendered inactive by coating it with varnish or other suitable non-conducting materials. The linen cloth, &c., is then affixed to the metallic side of the plate by cementing or otherwise attaching the edges, immersed in a solution of copper, and connected with the zink end of a galvanic battery—a plate of copper in connexion with the opposite end of the battery being immersed in the solution, when metallic copper is deposited on the surface of the metal plate in contact with the cloth, between the plate and the cloth. As soon as the surface of the plate is covered with a thin film of copper, the depositing metal begins to permeate the interstices and fibres of the cloth, and, if the process is continued long enough, eventually insinuates itself through the substance of the cloth, appearing in metallic globules on the opposite side. When the required substance has been attained, the cloth is to be removed from the solution and separated from its matrix; if the metal plate or matrix employed has a plane polished surface, the coppered surface of the cloth will be polished likewise; but if the matrix is engraved or embossed, the metallized surface of the cloth will be a fac-simile thereof: the most beautiful and elaborate designs being produced with the same facility as plain surfaces.

Ornamented metallic designs may also be produced on cloth and similar fabrics from plain metallic matrices, by drawing thereon the required design with some suitable non-conducting substance. A compound underlaying plate, composed of a plate of copper, and another plate formed of an alloy of lead and antimony, is recommended.

If a great length of cloth, &c., is to be coated with copper, the following process is adopted: Within a wooden trough a plain or engraved copper roller is mounted in suitable bearings, and beneath it is a plate of copper in connexion with the copper pole of the battery; the cloth to be metallized is led over suitable rollers, down under the copper roller, and up over other rollers. The trough being filled with a solution of sulphate of copper, and the copper roller connected with the zink pole of the battery, a very slow motion is given to the cloth, which, as it passes through the cupreous solution in contact with the copper roller, becomes coated with metallic copper, which is a fac-simile of the roller, whether it be plain or engraved. Or the following process may be employed, and the trough done away with: A plain or engraved roller of copper is mounted in bearings on a frame, and connected with the zink element of a battery; a second cylinder of copper, thickly coated with felt or other fibrous material, and connected with the copper element of the battery, is mounted in contact with the first; the cloth to be metallized is made to pass slowly between the two rollers, while a solution of copper is allowed to drop on to, and saturate the felt-covered roller. The battery being in action, the cloth passes slowly between the two rollers, and receives in its progress a coating of copper, the surface of which will be the exact copy of the roller.

When the cloth, &c., to be metallized, does not exceed 20 or 30 feet in length, the following apparatus may be advantageously employed. A wooden trough of the required dimensions is filled with a solution of the metal to be deposited, in which are placed

a number of cylindrical porous vessels filled with a solution of common salt or other exciting fluid; within each of these vessels is placed a cylinder of zink. On each side of these vessels is placed a plate of copper or other metal. The zink cylinders being connected with each other and with the plates, a galvanic arrangement is formed, and the metal in solution will be deposited upon the inner surface of the copper plates, to which the linen to be coated has been previously affixed. The inner surface of the plates should be treated with plumbago, and the outer surface rendered inactive, as before directed. If the articles to be metallized consist of glass, glazed earthenware, or the like, the surface is to be roughened by grinding or etching; the parts to be metallized are then to be surrounded with a matrix or mould of metal in connexion with the zink end of a battery. Or the matrix may consist of biscuit plaster of paris, &c., noting, that if the matrix is a non-conductor, its inner surface must be made conducting, by means of plumbago, or other well-known methods. The article to be metallized is then placed in the solution with a plate of copper from the copper end of the battery. The deposited metal will fill up every interstice between the matrix and the enclosed article, leaving thereon a copy of whatever design has been employed, firmly affixed to the glass.

The patentee gives in lengthened detail various precautions necessary to be observed, with variations of the several processes, and concludes by describing some batteries which he has successfully employed for conducting the before-mentioned operations.

The first of these batteries, called the *concentric*, consists of a zink cylinder open at each end, in which is placed a cylindrical open-topped vessel of unglazed earthenware. Within this is put a cylinder of copper, and the series continued until the interior becomes filled up, taking care to put zink and copper alternately, with a porous vessel between them. The elements are to be connected in the usual way, and any of the ordinary exciting fluids may be employed.

The second, called the *mercurial battery*, consists of alternate series of copper and mercury, separated by porous diaphragms, and immersed in a solution of sulphate of copper.

The third, called the *magnetic battery*, consists of two circular arrangements of horse-shoe magnets placed concentrically one within the other. The outer circle of magnets are fixed, and enveloped with copper wire covered with silk, between the two ends of which, when the battery is in action, an electric current is transmitted. When the poles of the inner circle of magnets stand opposite to the contrary poles of the outer magnets, no electricity passes; but on moving the inner circle round so as to bring similar poles in opposition, a current of electricity passes through the wire coil. So that by communicating a rapid motion to the inner circle of magnets, a rapidly intermitting flow of electricity passes off from one wire to the other; its intensity being proportioned to the number and size of the magnets, length of the covered wire, and the velocity with which the magnetic circle is made to revolve.

THE "TUDOR ARCH"—(P. 25, CURRENT VOL.)

The very imperfect way in which your engraver has given the representation of the Tudor Arch, proves this, that he, as well as architects in general, have no means of drawing a fair line for such a purpose by simple continuous motion. It is true, he gives the general impression of the broken-backed Tudor Arch by the common mode of drawing it. But how? Why, by first drawing two lines by the common imperfect plan, and then, an intermediate line *still more* imperfect. In short, the two outer lines, when compared with a fair continuous line, appear as imperfect as his intermediate caricature, as you will perceive by the original.

JOSEPH JOPLING.

29, Wimpole-street, July 13, 1844.

Screw Propellers on Canals.—Steam tugs with screw propellers have been successfully introduced on the Union Canal. An experiment with one of these steamers took place a few days ago. The boats are the first of the kind introduced into Scotland. They are built of iron by Messrs. John Reid and Co., Port Glasgow; and the engines, screw propellers, &c., are fitted up by Mr. William Napier, sen., engineer, Glasgow. The engines are on the upright principle. They communicate their power to the screws placed on each side of the bow; and by a very nice arrangement of wheels with wooden and iron teeth (in order to prevent noise and vibration) they are driven at a great speed without creating any of that surge or wash on the banks which has hitherto formed the chief objection to the use of steamers on canals. The result of the experiment gave great satisfaction to all present; and, independently of the gain in point of speed, it is calculated that there will be a considerable saving in expense, compared with the ordinary mode of tracking by horses. The steam-boat had attached to her six very large scows deeply laden, but it is capable of towing double the number without material diminution of speed. The scows to be tracked are connected together by rods having a parallel movement, and all under the control of the steersman on board the steamer, so that the necessity of a separate rudder and steersman for each scow is avoided—the whole train moving along with a steady and uniform motion.—*Glasgow Citizen.*

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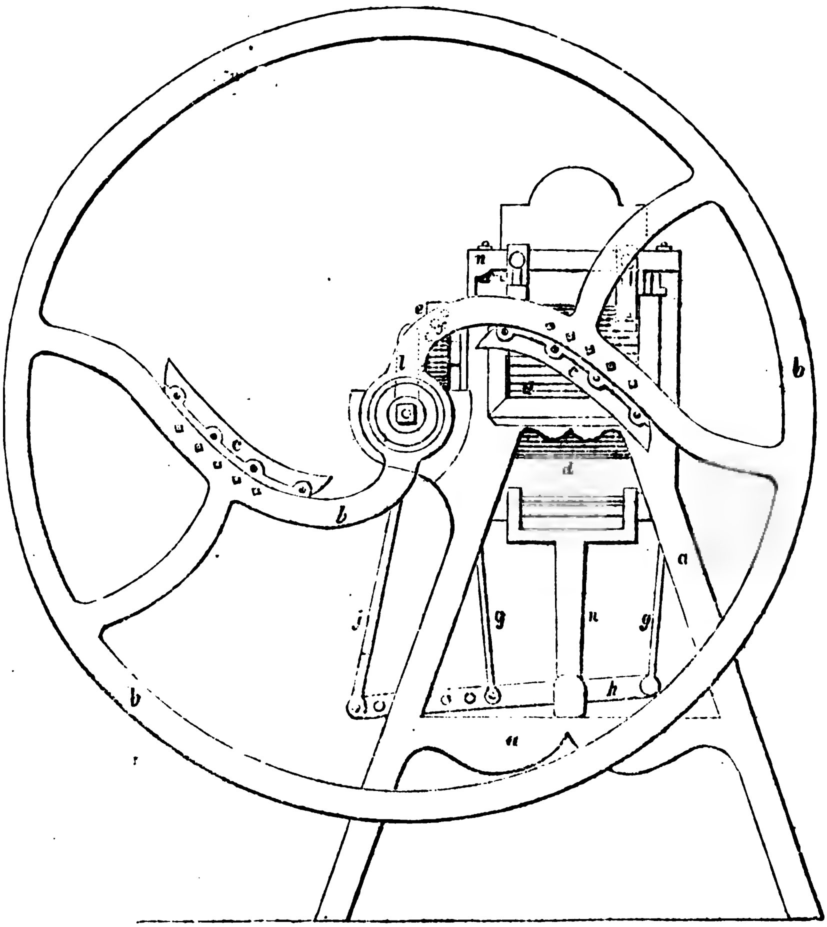
GARRETT'S PATENT CHAFF-CUTTER.



GARRETT'S PATENT CHAFF-CUTTER.

[Patentee, Richard Garrett, of Leiston Works, near Saxmundham, Agricultural Implement Maker. Patent dated Nov. 25, 1843; Specification enrolled, May 25, 1844.]

The prefixed engraving is an elevation of this improved chaff-cutter: *a a* is the framework of the engine; *b b*, the fly-wheel, which is mounted in front of the mouth of the machine and furnished with two cutting knives *c c*, which are firmly bolted to it. The material to be cut into chaff is fed forward by the fluted rollers *d d*, which have an intermittent motion communicated to them by means of the clicks or catches, *e e*, which take into and drive the teeth of the ratchet-wheels *f f*, which are mounted on the axles of the fluted-rollers *d*. The catches *e* are worked up and down by the rods *g g*, the lower ends of which are connected to a lever *h*, which is worked by the crank *l* and crank-rod *j*. The crank *l* is on the driving shaft of the engine, and rotary motion is communicated thereto from a winch handle in connexion with the fly-wheel *b*, and at the opposite end of the driving shaft a pinion is mounted, which gears into a corresponding pinion, so that by placing another winch on the axle of the latter, additional power may be employed to drive the machine. The fluted rollers, *d d*, turn in slotted bearings. They are kept in contact with the stuff which is to be cut by means of the weighted lever *n*, so that they may yield to an accidentally increased thickness of feed, and not choke or work hard, as will sometimes be the case with the ordinary chaff engines. The length of the chaff is regulated by altering the position of the connecting joint of the rod *j* along the lever *h*.

The same patent includes an improved Drop Drill, for which the Royal Agricultural Society have just awarded to Mr. Garrett 20*l*. and a silver medal; it is thus described:—

"By this 'Drop Drill,' seed and manure may be dropped at intervals in patches, and a sufficient quantity of mould covered over the manure before the seed is deposited upon it. The parts are so arranged, that patches of manure are dropped at suitable distances, and the seed dropped at the same intervals on the patch of manure previously dropped, and which has been covered with mould. The machine consists of two pipes, down which the manure is fed in proper quantities by peculiarly-shaped scoops. The lower end of the lowest manure pipe rests on a table fixed to the coulter, an opening being left between the coulter and the table, and as the manure descends it falls on the table, from whence it is pushed off, and down through the opening on the ground by a reciprocating or other action given to the lowest manure pipe, from an eccentric or a shaft, through the intervention of a connecting rod. Immediately behind the manure pipe, a fork is mounted for covering the manure with mould previously to the seed being deposited therein. The seed pipes are fixed behind this fork, and are fed with seed in the ordinary manner, and the lower pipe is furnished with a valve formed of a cylinder with a portion of its circumference cut away, so as to form a recess for containing the seed; the axis of this cylinder is cranked and worked backwards and forwards by means of a rod connected to the manure pipe. The seed pipe is preceded by a coulter and followed by a small chain harrow for covering over the seed."

The claim of Mr. Garrett, under this head, is to the "dropping the seed and manure down separate pipes at intervals in any required quantity, and covering the manure thus dropped with soil before the seed is deposited upon it."

Mr. Garrett also lays claim under this patent to "making the drum or beating cylinder of thrashing machines of *iron*, instead of wood;" but this is a claim which would hardly hold good in law.

SYSTEM OF MATHEMATICAL PUNCTUATION.

Sir,—Having stated in a former communication (dated Jan. 11, 1843, and inserted in your Magazine, No. 1022,) that I would be glad to state at greater length my reasons for conceiving that a system of punctuation more mathematical is desirable for scientific treatises, I resume the subject. I shall refrain as much as I can from touching on grammar or logic as connected with this branch of science: because they seem too remote from the departments of science with which your Magazine is chiefly occupied, and for which, I suppose, it is chiefly intended: but to some of your readers I believe the

subject will be as welcome as I conceive it is important; and many may have neglected the subject entirely from not having viewed it in the light reflected by candid investigation,—because pointing is generally left for the superior judgment of the compositor of the printing types, and to that of the printing-office "reader."

Of the mathematical system, one advantage most important appears to be a more extensive diffusion of scientific literature. As there is an *acknowledged* relationship (or connexion) amongst all the exact sciences (whether architecture, engineering, music, or any department of mathematical philosophy)—association with any one always befitting us for the relish of others; I think the time has nearly arrived when a mathematical punctuation will be adopted in all superior literature,—and superior literature is rapidly descending to the level of the labourer and artizan: and, now, to whom, I ask, do we look for the exact execution of the plans of the architect of edifices to adorn the material portion of the civilised world,—or for the exact execution of the plans of the engineer on whom our greatest modern achievements depend? To whom but the labouring artizan—whose association with, and love of, exact science (if allied to moral purity) are so greatly to be desired by all aspirers to the truthful of ornament or superiority of "finish;"—there is a repugnance, I believe, much greater than is suspected, amongst the labouring ranks generally, to read works whose words form "finely rounded" periods, on account of difficulties with which the learned have not to contend: those who have acquired grammar and logic have become familiar with forms of expression whose signification is obscured from those who have been educated, in language, from mere spelling and reading, without even introduction to the etymological branch of grammar; but many a "self-taught" mechanic, I believe, pants for a better guide to the archetype of a writer's mental vision than what is afforded to him (during his short repose from the toils of his servitude) by our present synonymical unfitty "system,"—his limited command of time, &c., will not allow him to re-peruse often the book requiring his notice—his key but too seldom does unlock the door to the depositories of those treasures which others have gathered, and he bitterly feels the want of those "previously acquired notions of the necessity (or propriety) of the case" for the supply whereof he is taxed so beyond his resources, and so much to the injury of society, which thus loses the intellectual energy of many amongst the neglected masses who are consequently led to debasing pursuits and to mischievous violence:—it becomes, then, an enquiry worthy of attention whether or not employment might not be supplied to many (of mathematical talent) now in penury for want of employment such as the great Architect has evidently adapted them for: there are, amongst our artizans, many to whose superior cultivation (and ably-directed powers) we owe that fascinating charm of superior "finish,"—many of these might have their talents directed to pointing which may become a new source of instruction in every walk of life:—Candid reader, might not this be effected and much good result? I believe it might! Then, if you coincide, let us remove the synonyms that thus enable men to quibble with those *pausers* which are the instruments for showing the boundaries—for grouping, into their respective families (exhibiting every shade of relationship), the words that flow, in beauteous order, from many who, like Demosthenes, in Greece of old, or Pitt and Fox and Burke, &c., nearer to our own time,—win the applause of audiences of the great and good, even, and lead them (by oratory's power) to discriminate (as well as feel) as they (the speakers) do. I claim not, Sir, the discovery of literary gravitation; but I profess to be able to prove that a literary gravitation does exist and capable of being exhibited (in its various degrees, &c.) by the application of the mathematical scale whose rules are those of unerring truth, —a scale, described on a sentence-weighing machine, by which the literary architect may erect a structure from which those worthy thereof may view (through description) operations and relations, &c. with a minute distinctness otherwise unapproachable and eclipsing totally any view obtainable, through surface language, in any past ages of the world. I call my plan an application of those numerical powers which, simple though they be, conveyed first, to Newton, the intelligence of previously unrecorded laws.

I divide the point family into the two following classes—

1. Word points;
2. Group points;

and the fundamental rule I contend for, and which differs from any I have hitherto met with, is that every point will require regulating according to the preceding and following points: but the greatest obstacle to minute exactness with our present points is the duty of preserving neatness of typography and this may be accomplished by a trifling addition to our "point family." *Word points* are expressed when additional words are used to qualify or explain only one single word preceding them, and therefore not extending their influence beyond that word. *Group points* are expressed when more than one word is qualified or explained, &c. by the adjoining word, or group of words, separated from them by a point of greater power than any point separating the members (if more than one) of the group formed by themselves.—These are two grand distinctions in perspicuous oratory as yet unexpressed in silent surface-language; but which are quite at variance with the rules given in our latest grammars,—their writers only professing to give rules consistent with adopted practice, and yet I find, in those I have examined, no approach to my present system, though such is evident in modern typography. Arnold quotes, to support his rules, from Buttmann and Matthiæ and Middleton: but punctuation is the life-giving principle which *hitherto* has *only partially* rescued the "views of the far-seeing" from their obscurity.

I now proceed to show how our present points might be variously used, though perhaps destroying, somewhat, typographic neatness: and first with regard to word points, which I subdivide into separators and joiners. All unhyphened words are properly separated by a word-space (which printers call thick-space) but varying in prose, according to the "whim" of the words to fill lines of equal length,—which words ought to be exactly equally separated—long letters at extremities claiming a little extra share of any surplus space when the common word-space is not sufficient, between each word, to make them fill the line. All words are separated by a space, though they are also connected by proximity: and the common distinguisher of words is the word-space. Next we require separators (expressing less connexion) and joiners (expressing greater connexion). For word-joiners we are limited, at present, to the hyphen, to which we may add the comma hyphened,—thus "-" ",-"; and for word-separators we may employ the comma, the double-hyphen, and also the comma double-hyphened,—thus "," "- -" ",--" the words being unspaced from the hyphen preceding.

In our present imperfect manner of pointing, the comma and the full point are never spaced from the preceding word; but, to make the comma serve as a group-point and also as a word-point, they must be spaced as are the semicolon and colon,—excepting the space separating them and the word *following*,—and which, for the comma, may be a mere word-space instead of the greater space used after the other points: the bracket and parenthesis may be used as word-points. Thus, in addition to the former arrangement of points, we may gain, from the commonly-used types, the following (with their numerical value attached)

WORD POINTS.

Joiners.

$\frac{1}{4}$	$\frac{1}{8}$	
,-	-	inferior to the word-space.

Separators.

$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{3}$	
,- -	,	- -	and superior to the word-space.

The group points were given at page 198 of vol. xxxviii;—but, in addition, the capital letter is used, in legal composition and Acts of Parliament, for showing the commencement of a distinct group, and where much internally divided, great advantage is gained by thus showing its commencement; it is also employed, in the Bible, at the commencement of every quotation, &c. within a sentence—though the termination is not expressed by any mark. Where a group is closely connected with another group (or word) adjoining, I propose the use of points nearly similar to those now used for inclosing quotations—and which might be straight lines (thus „ ″) instead of apostrophes and inverted commas; and thus, where the connexion is as close as that of the nominative and its verb, such may be expressed without destroying (by additional points, as is now done) the

value of any point occurring in the distinct group.

I have not mentioned the notes of exclamation, or interrogation—the Spaniard wisely places them at the commencement as well as the end of the groups to which they apply.

It will be seen that I have only partially adopted the mathematical system in my composition: but I shall send you some specimens if you will kindly allow space for their publicity in your columns. With regard to the proposed new points for inclosing groups that occur within sentences, mathematical men might suppose the crotchet and parenthesis (as used in algebraic formula) adapted to the purpose; but that would be diverting them from the purposes for which they have hitherto been used, and for which they are well adapted. The following quotations may be sufficient to show the opinion formerly held with respect to this infant science.

"FROM CHAMBERS'S CYCLOPÆDIA, LONDON, 1741.

"*Punctuation* is a modern art: the ancients were entirely unacquainted with the use of our commas, colons, &c., and wrote not only without any distinction of members and periods, but also without distinction of words; which custom, Lipsius observes, continued till the 104th Olympiad; during which time the sense alone divided the discourse.

"The antiquity of *pointing*, however, has had its advocates; some have ascribed the invention of it to Thrasymachus, who was contemporary with Plato: others to Isocrates, who flourished about the same time; and others to Nicanor, in the time of Adrian. A late writer observes, that *pointing* was not unknown in the time of Alexander the *Great*. Aloysii, Antonii, Verneii, &c., de Orthog. Lat. Rom. 1747."

"Cicero's expressions, *verborum et sententiarum interpunctas clausulas in orationibus*, Lib. 3 de Orat.; and, *clausulas atque interpuncta, verborum, &c.*, in his Orat. pro Muræna, have been alleged by some as evidences of the antiquity of this practice; but others have referred the former words to speaking, and not to writing; the latter to those points which were formerly placed after each word, in order to distinguish word from word, when the whole was written in large capitals, at equal distances from one another; which is a very different thing from that sort of *punctuation*, which divides the sense and subject matter into members and sentences and parts of sentences, in such proportions as either the sense or the construction may require. The words of Seneca in his 40th Ep. *Nos etiam cum scribimus interpungere solemus* are more applicable to this latter sort of *pointing* than those of Cicero; and yet these have been understood to refer to the distinction of words. See an Essay on the Use of *Pointing*, by Sir James Barrow, F.R.S. and F.A.S., 4to, p. 6."

In the same work (Chambers's Cyclopædia) we are told that there is scarce anything in the province of the grammarians so little fixed and ascertained as this. The rules usually laid down are impertinent, dark, and deficient; and the practice, at present, is perfectly capricious, authors varying not only from one another, but also from themselves.

Grammarians have been misled by a TOO LIMITED observation of correct speaking. In mathematical punctuation, every word will show what relation it bears to the surrounding words as exactly as is the case in spoken language when it is most intelligible: and this cannot be effected by placing a point wherever we make a pause merely; for punctuation—or the varied connexion of words and groups thereof—is chiefly expressed by the tones of the voice; and, by attending to mere cessation of voice, grammarians have been induced to give numerous rules that but lead to increase synonymous signs for very different objects.

J. M. B.

Lancaster, June 5, 1844.

HOW TO PREVENT LETTERS BEING OPENED WITHOUT DETECTION.

Sir,—The excitement which has for some time occupied the public mind as to the very reprehensible (I wish I could say *un-British*) practice of opening letters in the post-office—a practice which, however legal it may be, and however much sanctioned by precedent, seems for the first time latterly to have been brought into an odious notoriety—has suggested to me the publication, through your Journal, of the following hints to correspondents, by adopting which they may set the ingenious licensed burglars of secrets in Her Majesty's Post-office at defiance, and compel them, if they will have the contents of a letter, to break it open, and show that they have had them.

Steam or hot water will open a wafer—

a hot iron or spirit lamp loosen a waxen seal—after the instrument of forgery, the plaster cast, has been taken from it; but by several combinations of both, all power of opening a letter without violence is removed. Thus, let the letter be first sealed with a *small* wafer, well moistened, cutting a small hole, say $\frac{3}{16}$ of an inch diameter, through the upper paper, directly over the wafer; upon this spot, having pressed down the wafer, drop as much sealing wax as will completely cover the wafer, or rather more, and seal with the usual seal. Now neither dry heat nor moisture will open this, nor will *dry steam* be hot enough to melt the wax.

Further difficulty may be given to "the secret office" thus:—touch the face of the wax seal over as soon as made with turpentine varnish mixed with a little linseed oil. This leaves a sticky face, from which a plaster cast cannot be taken.

Or, adopt the very beautiful method of forming the surface of a seal invented (I believe) by the late Sir John Robison, secretary to the Royal Society, Edinburgh, viz., Dip the seal, after having breathed upon it, in bronze powder; pass the ball of the thumb over the projecting parts of the seal, to remove the metallic powder, leaving it in the intaglio; and instantly apply it to the hot wax. The impression is left, with the projecting parts covered with the bronze, and the effect is very beautiful when neatly done, and the contrast of colour between the wax and the bronze well chosen. Now when this method is adopted, if a plaster cast is taken of the seal, the bronze will be removed upon it; or if the seal be melted, it will be mixed through its substance; and a subsequent application of bronze from a plaster seal would be scarcely practicable.

The following method in use in Prussia (where the post-office is very curious in private intelligence) is also effectual:—Punch a hole of about $\frac{1}{4}$ inch diameter with a hollow punch through a common large wafer; seal the letter with this moistened in the usual way; but before closing, place a drop of Canada balsam in the cavity or hole of the wafer, and press down upon it; place the letter in a warm place for a couple of hours, and neither heat nor moisture will open it.

Another method, and probably quite as effectual and more simple than any of the others, would be to secure the envelope all round the edge, with a narrow joint made with India rubber dissolved in the most highly rectified caoutchoucine (sold by Messrs. Enderby) or in cajiput oil. As soon as this hardens, which it will do in half an hour, no known agent can open the packet without its destruction, or leaving marks of violence. It may be sealed or not in any common way besides, if thought desirable.

Why do not some of the large envelope makers get up articles for sale upon some of these plans, (or a better if it can be devised,) to render correspondence practically as inviolable as the public have heretofore believed it to be?

I am, Sir, yours, &c.,

R. M.

July 22, 1844.

THE PATENT ARGAND FURNACE.

Sir,—However Mr. Williams may be *an inventor* of the method of dividing the stream of air caused to mingle with the inflammable gases in his furnace, by passing it through a number of small apertures, he is unquestionably not the first inventor.

In the "Annales des Mines" for 1836, tom. x. page 235, a paper of great interest occurs, by M. Virlet, a civil engineer, descriptive of certain new methods of carbonising wood by means of the vast heat from the flame at the mouth of iron furnaces, fed with charcoal. In this the following passage is found:—

"As the gases which escape from the furnace are not always inflamed, and it is necessary, in order to render them inflammable, that they should be mixed with a *certain quantity* of atmospheric air; it is required to arrange in the masonry which surrounds the apparatus, and principally towards those points, when these gases are introduced into the apparatus (*i. e.* the gases of the blast furnace), namely towards the mouth, (*gueulard*) a certain number of apertures of 1 or 2 inches each, which can be closed if desirable; these serve for the introduction of atmospheric air for facilitating the introduction of the gases. *It may be asserted universally, that the combustion of these gases takes place more perfectly in proportion as these apertures for the introduction of air are more numerous*, and as in the conditions of the apparatus a very rapid draft is not required, but only sufficient to give direction to the flame, there is no fear

of introducing *too much cold air* into the apparatus, *which might produce a certain amount of cooling effect.*"

Here the principle of dividing the streams of mixing air and gases is clearly recognized, as well as the other principle upon which Mr. W. lays so much stress, viz.: the precise determination of the enough, and not too much air; but in truth, Tredgold, in his valuable book on Warming and Ventilating, as may be seen, at page 113, and *passim*, clearly saw this principle also, and has said all that can or need be said upon the subject, with perfect chemical accuracy, although, certes, with very little pretension or parade. To Mr. Williams belongs the merit of having more fully insisted upon the known principles of burning coal as perfectly as possible, than had been before done, and put them in a light which would have been clearer if not obscured by a needless parade of chemistry.. But after the inventions and publications of Watt, Thompson (Count Rumford), Tredgold,* Virlet and others, it is difficult to see the ground for any pretension to originality in his arrangements for combustion.

After all, perfect combustion of coal in furnaces is a humbug, and the smoke bill now in embryo must either be a nullity or a nuisance, whose burden, if enforced, will be intolerable; for with any arrangement or contrivance of furnace, the appearance of smoke is at the mercy of the stoker, and of a hundred little contingencies that, together, make a smokeless, furnace too nice an instrument for vulgar use.

IGNIS.

MORDAUNT'S PATENT PROFILE DELINEATOR.

Sir,—In the speech of Lord Chief Justice Tindall, at page 29 of your current volume, his Lordship observes, that "an invention having been made public by any description contained in a work, whether written or printed, which has been publicly circulated, in such case the patentee is not the first and true inventor within the meaning of the statute, whether he has himself borrowed his invention from such publication or not, because we think the public cannot be precluded from the right of using such information as they were already possessed of, at the time the patent was granted."

Now, Sir, it appears that so long ago as November 12, 1825, you published in your 116th Number a description of a simple apparatus for taking the shape or pattern of mouldings, &c., which was followed in your 118th Number by a communication of mine containing an important improvement upon the original idea. Another correspondent, evidently unacquainted with my suggestion, in your 335th Number, suggested another modification of the apparatus.

The identical apparatus, as improved by me, has been recently *patented* by a Mr. Mordaunt, of Clifford-street, Bond-street, under the title of *improvements in apparatus for obtaining the profile of various forms or figures*; sealed November 21, 1843.

According to the dictum of the Lord Chief Justice before quoted, Mr. Mordaunt's patent is void; a matter, however, of no great moment, seeing that the invention is not calculated to make anybody's fortune. The circumstance shows the necessity of taking "good advice" before incurring the outlay necessary to the attainment of *letters patent*, and I may remark, that this is only one of many inventions, which I have given to the public, that have been patented by subsequent discoverers.

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, July 7, 1844.

A SIMPLE METHOD OF TRACING UPON THE SURFACE OF A CYLINDER SPIRALS OF ANY GIVEN CONSTANT OR VARIABLE OBLIQUITY.

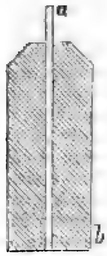
Sir,—For many purposes of the arts a simple and rapid method of tracing spirals upon a cylindric surface is important; carvers, wood-turners, &c., often want such, and in larger works, such as some particular branches of millwork and engineering, it is also frequently wanted.

The usual method, by dividing the cylindric surface into equal portions in circumference and length, and drawing diagonally, is tedious. The following method, believed to be new, is simple and ready, and sufficiently exact for most purposes. Two straight edges of equal length and width, and about ⅜ths of an inch in thickness each, are to be secured on a table, parallel to each other, standing on their edges, and distant from each

* Alas, poor Tredgold! How many thousands have borrowed and benefited by the productions of his "seething brain," without acknowledgment or a grateful thought bestowed upon the memory of the poor overwrought author, or of his unprovided and orphaned family.

other by nearly the length of the cylinder upon which the spiral is to be marked. Between these there is to be also secured, in a diagonal direction, stretching from one to the other, a third straight edge, formed of two slips of deal glued together, with a slip of straight cut thick Bristol board between them, projecting ⅛th of an inch at one edge. The section will then be thus.

Fig. 1.



The entire height of this from *a* to *b*, when standing on the table, must be a *shade* more than that of the two other straight edges. The three pieces being then thus arranged, the edge of Bristol board is charged with printer's ink. Then, on causing the cylinder to roll over the edges of the two parallel straight edges, in the direction of their length, the diagonal slip of inked Bristol board will trace a spiral upon the surface of the cylinder with very considerable accuracy.

Fig. 2.

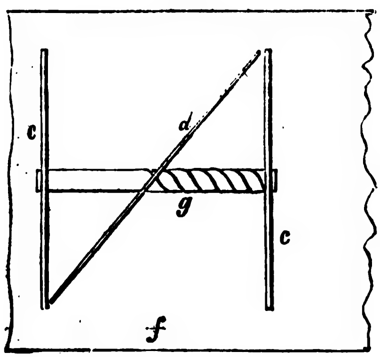


Fig. 2, *c c*, the parallel straight edges; *d*, the diagonal tracer; *f*, the table; *g*, the cylinder, partly traced. The obliquity of the tracer with respect to the straight edges will be an angle equal to that which the spiral at any point is intended to make with the axis of the cylinder. Hence, if the obliquity of the spiral, or pitch of the screw, is to be variable, the tracer, in place of being straight, must be a curved edge, the angle formed with the straight edges (or rolling bars, as we may call them,) varying as determined.

The length of the rolling bars will be equal to the circumference of the cylinder to be marked, as many times as the number of revolutions of the spiral.

Spirals may be marked on the surfaces of cones in this way, and the method is peculiarly applicable for marking on the large scale the trace spiral of screw propellers.

Polygonal prisms may also be so marked with spirals.

For marking upon metallic turned surfaces, the trace of large original screws, there must be substituted for the Bristol board tracer, one formed of two sheets of thin brass, meeting at an acute angle, and charged between with printing ink. While the upper edges of the rolling bars, must be covered with a surface of buff leather, both to prevent slipping (for which end the metal surface and these should be chalked,) and to allow by compression of firm contact between the metallic cylinder and the inking-tracing bar, which is like a sort of continuous-drawing pen. In section thus: K K, plates of brass;

Fig. 3.

Q, space for ink; S, wood base. I have found this simple arrangement useful on several occasions, and am anxious thus to make it more so.

ROBERT MALLET.

Dublin, July 17, 1844.

LIPSCOMBE'S PATENT APPARATUS FOR LESSENING THE VIBRATION AND NOISE OF RAILWAY WHEELS.

[Patent dated, August 16, 1843; Specification enrolled, February 16, 1844.]

It is now generally understood that the rapid deterioration as regards the strength of railway wheels and axles, is chiefly caused by the intense vibration to which they are subjected. This can readily be made evident:—If the journal of an old railway axle is struck with a smith's hammer, it will in many cases break off with a single blow, presenting at the fractured part a weak brittle appearance; whereas the journal of a new axle will take several hundred blows before breaking, a tough fibrous appearance being presented at the fractured part. Suppose a finger to be in the act of creating a musical sound by laterally distending a harp string, it is plain, if the finger is taken away, the elasticity of the string will cause it to fly to and fro, until from the friction of its fibres, the string is brought to a quiescent state. Now it is clear that the same effect would be produced by deflecting the harp string with a weight, and suddenly withdrawing that weight. We thus see, as the weight upon a wheel in motion is ever shifting, the particles composing a wheel are successively deflected every revolution, the weight shifting with a rapidity depending upon the speed of the wheel. It follows, as in the case of the harp string, that the deflected particles, immediately the weight is shifted, will begin and continue to vibrate until the wheel stops: the consequence is, either the spokes become loose, thus rendering the wheel useless, or the particles of the wheel by being wedged and dovetailed together, become by this wriggling motion so loosened and broken, as in a few years to render the wheel unsafe, consequently useless, from its great decrease of strength, although the actual quantity of metal in the wheel remains the same as ever.

The same remarks are applicable to railway axles.

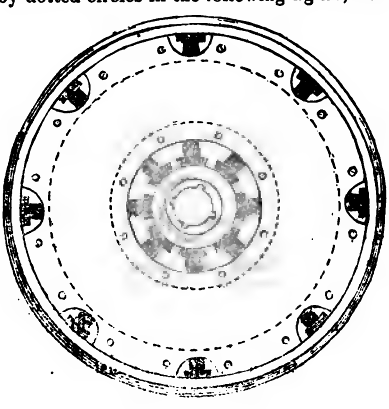
The vibration which takes place in a wheel is communicated to the axle, as the axle is struck by the vibratory particles of the wheel. That this is exceedingly destructive to wheels and axles, is sufficiently attested by their great decrease of strength, and the pecuniary loss every railway company sustains from this cause, together with the accidents which have occurred by the breakage of axles.

Mr. Lipscombe, after a variety of experiments, ascertained that any metallic body could be prevented from vibrating, by simply pressing a quantity of sawdust, &c., in contact with it, so that when the particles of a body are deflected by a weight, their elasticity when the weight is withdrawn is spent in forcing back the sawdust, while resuming their original position.

An apparatus was constructed and applied to the wheels of a ballast wagon by way of experiment, and exceeded the most sanguine expectations formed of it. It completely prevented vibration, not only in the wheels, but in the axles; the noise of the wheels was very slight, the little noise produced being occasioned by passing over loose or sunken joints; and the wheels, as may be supposed, from the absence of vibration, had a very easy motion.

The patentee subsequently, through the recommendation of Mr. Robert Stephenson, obtained permission of the directors of the London and Birmingham Railway, to apply his apparatus to one of their first class carriages. Previous to the wheels being placed under the carriage, one pair, with the apparatus applied, was slung off the ground, and struck in various parts of the axle and wheels, but not the slightest vibration could be detected. Another pair not fitted with the apparatus was afterwards slung in a similar manner, and when struck, produced a sound as loud and prolonged as a bell would have done. The carriage has been running daily with the trains for upwards of nine weeks, and is a great favourite for its peculiarly smooth motion and comparative noiselessness, although from being in a train with carriages before and behind it, the ears are assailed by their noise.

The apparatus is very simple, consisting of a plate of zink placed on each side of a wheel, for the purpose of retaining sawdust in contact with part of the rim and spokes; each plate has two wooden rings of unequal size permanently fixed to it, the external diameter of the smaller ring, and the internal diameter of the larger ring, are shown by dotted circles in the following figure, and



are likewise flush with the edges of the zink plates. The combined depth of the corresponding rings is equal in width to the tyre; these rings meet and are screwed together, certain parts of the rings being cut away to let in the spokes. By a reference to the figure, it will be seen that the ends of the spokes, adjoining the nave and tyre, are left exposed for the purpose of noticing any defect which may take place in those parts.

The apparatus may be detached from the wheel, by simply taking out the screws which hold the corresponding rings together, and is applicable, with slight modifications, to all existing metal wheels. The cost of the apparatus is 1*l.* per wheel, and it will last for many years.

Wheels formed of a combination of wood and iron are in partial use upon some railways for the purpose of dscreasing noise and vibration, which still exists, notwithstanding, to a very considerable extent. It must be recollected that all bodies are vibratory—the harder and more fibrous a body the more freely will it vibrate; therefore it is utterly impossible to use any material tough enough to form part of a railway wheel but which will vibrate and create considerable noise, unless a non-vibrating substance, such as sawdust, is placed in contact with it. The disadvantages and danger of railway wheels formed of a combination of wood and iron are well known to engineers, as far counterbalancing their slight decrease of vibration and noise.

There cannot be a doubt that an iron wheel prevented from vibrating would be the safest, most durable, most economical, and the most noiseless, with a smoother motion and less draught than any other description of wheel.

The advantages of having iron wheels fitted with this apparatus are these :—

To Passengers.

1st. Much less noise, especially when passing through bridges, tunnels, over viaducts, &c.

2nd. The avoidance of that unpleasant sensation arising from vibration ascending from the wheels to the body of a carriage: in first-class carriages this is partially got rid of, by the cushions, &c. acting as non-conductors of vibration.

3rd. Less danger of accidents from the breakage of axles and wheels, as this apparatus preserves the strength of the metal composing them.

4th. By its application to a train from the little noise which would then exist, should a passenger travelling in a train which stops only at first-class stations be taken suddenly and dangerously ill the guards could readily be spoken with, and these again could communicate with the engine driver, to stop at the nearest station for medical assistance.

To Railway Companies.

5th. It offers ultimate economy by preventing the deterioration of wheels and axles by vibration.

6th. The resistance of a train would be less; the spokes of the wheels being cased, are unable to offer any resistance to their motion; this is very different with wheels whose spokes are permitted to beat the air, thereby retarding the motion of a train; again, every engineer will acknowledge that a non-vibrating wheel will require a less amount of force to move it, than one whose vibration increases with its speed.

7th. Less wear and tear of axle brasses, from the fact of no vibration existing in either wheel or axle; it is evident the more rubbing surfaces vibrate, the greater is their friction, as instead of being smooth, their surfaces are rendered undulatory so long as vibration continues.

Vibration may account for greater friction existing when wrought iron rolls or slides upon wrought iron, than when it rolls or slides upon cast brass, which, vibrating very much less freely than wrought iron, consequently retains a smoother surface.—*Railway Record.*

CAPTAIN WARNER'S SECRET DESTROYER.

(*From The Times.*)

When Captain Warner, a few years ago, announced that he could send a line-of battle ship or a whole fleet to perdition in a moment, annihilate a castle, a fort, or a town, with equal ease and expedition, the public thought he was drawing the long bow. *Mira fulminis opera sunt*, said they, but "really this is too great a demand upon our credulity." Thereupon Captain Warner was compelled to make a demonstration of the destructive power of his "invisible shell," or bottled lightning, but his experiments being conducted before few witnesses, and though successful, somewhat involved in mystery, he found the public mind to a great extent inaccessible to conviction. Sir R. Peel, indeed, having witnessed the tearing to pieces of a strong boat filled up with timber, at Wanstead, in the spring of 1842, went so far as to say that Captain Warner certainly did possess a fearful power, of the easy and practical applicability of which he required further proof. It will be recollected, that shortly after the present Premier came into office, a commission was appointed to investigate and report upon the merit of Captain Warner's discovery. That commission consisted originally of Admiral Sir Byam Martin and Admiral Sir Edward Owen; but the latter being ordered to the Mediterranean, Sir H. Douglas was appointed in his stead.

Some contrariety of opinion led to the retirement of both these commissioners, and they were succeeded by Colonel Chalmers and Captain Caffin. Meantime Captain Warner had urged upon the Government the purchase of his secret, and offered to exhibit its effects on a large scale, if the Government would defray the expense. He was then requested to send in an estimate of the expense, which he did, but the Government offered no more than one-fourth of the required sum, and the intended great demonstration was therefore not made. No more was heard of the matter, and people put down the "invisible shell" as being, beyond a doubt, an exploded affair, until the fact was reported that a London shipowner had presented Captain Warner with a large vessel, with a polite request that he would do him the favour to blow her to atoms if he could.

John O'Gaunt was the name of the devoted ship. She was a bark of 300 tons' burden, three-masted, tall, full-bowed, strong, and sea-worthy. On Wednesday last (17th July) she was towed by a steamer from Gravesend to Shoreham-roads, off Brighton, and moored there, the knowledge of which fact, and the renewed assurances of Captain Warner that he would fulfil his promise, excited the public curiosity afresh, and on Saturday, the day appointed for the explosion, all the world seemed to be at Brighton.

* * * *

It was nearly 6 o'clock before she was fairly towed to the position she was to occupy, about a mile and a quarter from the battery. Now two men who had remained on board to manage her helm, or do anything else that might be necessary, hurried out of her, and went off in a boat.

* * * *

It had been agreed between Lord Ingestre and other officers and Captain Warner, that he should hoist a Union Jack at the masthead of the steamer when he was ready to operate, and keep that signal flying until those on shore should hoist a Union Jack from the flagstaff on the battery, at any time they chose to select, which would be replied to by Captain Warner hauling down his signal, and then immediately the operation would take place. The *Sir William Wallace* having let go the tow line returned abreast of the *John O'Gaunt* for a few moments, but for what purpose we could not discover; she then took up her position about a quarter of a mile ahead of the ship. Captain Warner's signal had been flying some time before it was answered from the battery, and then arose another delay in consequence of some adventurous persons in a small cutter, going close alongside the ship. Captain Warner hauled the Union Jack half-way down only until the cutter and its foolhardy occupants were out of danger. The Union Jack was then hauled down entirely. Every one now felt that the grand crisis had arrived. Every eye was directed towards the scene of operations, and in less than five minutes afterwards the explosion took place. The instrument of destruction, whatever it was, seemed to strike the vessel midships, for, from that point a huge column of water, in which was intermingled some of the shingle of which her ballast was composed, shot up perpendicularly into the air higher than her highest topmast; her mizen went by the board, her mainmast, a new one, was shot clean out of her like a rocket; she heeled over to port to an angle of 45 degrees, and her main hatchway being open daylight was visible through her bottom timbers on her starboard side, and probably her larboard also, having been blown away, and she seemed to part asunder as she went down, leaving nothing perceptible but the top of her foremast. The time which passed from her being struck and her sinking could not have exceeded two minutes and a-half. Some few of the more enthusiastic spectators, chiefly professional men, raised a cheer, but with the mass all was mute astonishment. The eyes were riveted on the last observable fragment of the large object that but the moment before floated gallant on the waters "like a thing of life." The expression on the countenances of the multitude generally seemed to say—What was it? An illusion? A dream? A magical trick? A work of destruction so sudden, so frightful, so stupendous, appeared impossible for a moment even to the thousands and tens of thousands that witnessed it. It was like an awful mystery. There were none of the ordinary circumstances which accompany similar catastrophes. There was no smoke, there was no fire, there was no noise, save the low groan of the rending timbers, and the succeeding hush of the waters as they rolled over the instantaneous wreck, and then arose a melancholy feeling, for it was impossible to prevent the imagination depicting the terrific effects of such an explosion upon a peopled ship, thus silently and suddenly perishing.

* * * *

So far, then, as the destruction of the vessel is concerned, the experiment was completely successful. The object of Captain Warner was to show that, if chased by another ship, he had it in his power at any time he chose to annihilate his enemy, suddenly, at once, and without any warning. But the question was asked, and will be asked on every hand, "How was it done?" A very natural question, but not altogether

a very just one, for if Captain Warner disclose his secret he will go profitless. The answer which he gives to all such questions is, "That is part of my secret, and therefore I cannot tell you anything at all about it."

The following certificate by Captains Lord Ingestre, Dickenson, and Henderson, has been since published :—

Certificate.

"July 21.

"We, the undersigned, hereby certify that the operations against the *John o' Gaunt*, of 300 tons, conducted by Captain Warner, off Brighton on Saturday, the 20th instant, were under our management and control. We further certify that the explosion did not take place from any combustible matter either on board or alongside the ship, but was caused by Captain Warner, who was on board the *William Wallace* steamer, having the ship in tow at a distance of about 300 yards, and that the explosion took place in consequence of a signal made by us from the shore, the time of which was not previously known by Captain Warner.

"We further declare our belief that Captain Warner has never been on board the ship since she left Gravesend.

"Ingestre, Captain, R.N., C.B.
"T. Dickenson, Captain, R.N.
"W. H. Henderson, Capt. R.N., C.B."

Two important facts appear to be incontestably established by this experiment :— First, that Captain Warner is, in truth, in possession of the secret of an instrument of destruction, immeasurably exceeding in power everything hitherto known; and second, that he can also project it to any given point, at a distance of many hundred yards, with the utmost precision and certainty—which last is to us not the least remarkable part of this very marvellous affair.

ROWAN'S PATENT ANTI-FRICTION AXLE.

Since the description of this axle, published in our journal of the 15th June last, (No. 1088,) it has undergone a series of trials on the Ulster Railway; and we have now the pleasure of laying before our readers the following official report of the general result. It will be seen that it fully confirms the favourable opinion we had formed of the capabilities of the invention. We stated that the model experiments which we witnessed, gave a gain in power of full nineteen-twentieths, but that in actual practice there would be so many deductions to be made for unevenness in rails, bad joinings, &c., that we should not expect to see a net gain of more than one-third of that amount realized. The net gain is in point of fact very nearly so, being as 14 to 84, or 6 to 1.

The Report.

"MESSRS. JOHN ROWAN AND SONS.

"Gentlemen,—In reply to your letter, requesting my opinion on the working of your patent axle, which has been on trial on this railway, it occurs to me, that, by furnishing you with the facts which have presented themselves, during the experiments, you will be better able to judge of its economy and efficiency.

"Your axles, fitted to an ordinary luggage wagon, were running on this railway for a fortnight, without being oiled; and, when examined, at the end of that time, the axles and cylinders were perfectly clean, and in good order. The wagon was then loaded with upwards of four tons of iron rails, and ran one hundred miles per day, for six successive days, at an average velocity of thirty miles an hour. The axles were not oiled during that time; and, on examination, they appeared to be in perfect order. A series of experiments with the new, and, also the ordinary axles, were made. The wagons were each loaded with four tons; and the following results were arrived at :—

"14 lbs. moved the wagon with the patent axle 29 feet, from a state of rest; and 21 lbs. moved it 34 feet.

"It required 84 lbs. to move the wagon with the common axle 27 feet; and 112 lbs. to move it 31 feet.

"These experiments were made on the same rails, and under precisely the same circumstances.

"It is obvious, from the above-mentioned results, that a very considerable saving in power will arise from the use of your axle; and I feel no hesitation in giving my favourable opinion on this very ingenious and important invention.

I am, gentlemen, very truly yours,
"John Godwin,
"Engineer to the Ulster Railway Company.
"Railway Office, Belfast, 17th July, 1844.

THE "METEOR" STEAMER.

Sir,—When I reckoned extreme slightness of form and construction among the causes to which the high degree of speed attained by the *Meteor* was to be attributed, I gave the result of such examination as I had been

able to make since that vessel has been completed; and, not having had an opportunity of ascertaining by measurement the exact dimensions, I may possibly have been deceived in my judgment. The opinion, however, has not been confined to myself, as I have heard men of great experience in shipbuilding make the same remark.

If Mr. Cormack should prove, not merely, as he says is his intention, that she is as strong, or stronger than *any*, but even that she is as strong or stronger than *many* of her competitors, I shall willingly acknowledge that I was wrong in attributing her speed in any degree to that cause; and I doubt not, that your readers would thank him for data of the kind he mentions, which could not fail to be interesting.

I had much greater fear of being accused of prejudice in favour of, than against the *Meteor*, as my notice of her performances was very favourable, and assigned her a degree of speed, which many deny, and which she has not on all occasions attained.

I am, Sir, yours sincerely,

CURVE.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65. FROM JUNE 28TH TO JULY 24, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
June 28	207	T. H. Ryland	Birmingham	Rail plate or chair.
28	208	Binnion and Griffin	Bread-street, Hill-street, Birmingham	Design for a lens applicable to railway and carriage lamps, ship lights, and lamps generally.
29	209	Thomas Todd and A. W. Newbold	Hull	A design for a life-preserver.
„	210	Louis Marie Antoine Boiteux	5, King-street, Golden-square	Moveable mesh knife.
„	211	Thomas Halfpenny	St. Anne's-court, Soho, London	A machine for cleaning knives and forks, and other like articles.
„	212	Charles Lewis and Co.	Stangate House, Lambeth	Improved omnidirective shower bath.
July 1	213	Thomas Macdonald	Duke-street, Glasgow	Instrument for enlarging or reducing patterns or designs.
2	214	Charles Cage	3, Willow Cottage, Cannonbury.	A design for a frying pan.
3	215	Edward Boyd Roberts	32, Moorgate-street, City, and 239, Regent-street	Robert's hat-measuring, fitting and shaping instrument.
„	216	Joseph Hall	Cambridge	Wood and metal rake.
„	217	John and William Dent and Co.	Worcester	A glove.
5	218	John Graham	Liverpool	Design for a mill stone, to be called "The open skirted runner Mill Stone."
6	219	Walter Hancock	Stratford-le-Bow	Hat preserver and ventilator.
„	220	John and William Dent and Co.	Worcester	A flesh washer or rubber.
„	221	John Leach	Mile Town, Sheerness, Kent	A fire escape.
11	222	Charles Peter Gavin	39, James-street, Dublin	A fire plug.
„	223	Robert Stedall.	13, Nelson-street, Greenwich	Chimney cowl.
13	224	William Wallace	Lincoln	Lounging chair.
18	225	Lawson and Holden	Great Charles-street, Birmingham	Design for a rein holder and guide, intended as a substitute for ferrets, dees, &c.
24	226	Henry Tilley	Piccadilly, Westminster	Design for wood paving.

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN JULY.

AN ELEMENTARY TREATISE on ALGEBRA, Theoretical and Practical. By James Thompson, LL.D., Professor of Mathematics in the University of Glasgow. 5s.

A TREATISE on the STEAM ENGINE. By the Artizan Club. Part I. 1s.

THE PRINCIPLES of GEOMETRICAL DEMONSTRATION, deduced from the Original Conception of Space and Form. By H. Wedgwood, M.A., late Fellow of Christ College, Cambridge. 2s.

THE MEDALS of CREATION, or First Lessons in Geology and in the Study of Organic Remains; including Geological Excursions to the Isle of Sheppy, Brighton, Lewes, Tilgate forest, Faringdon, Swindon, Colne, Bath, Bristol, Crich-hill, &c. By Dr. Mantell. Illustrated by coloured Plates, and several hundred beautiful Wood cuts of Fossil Remains. 1*l*. 1s.

A DESCRIPTIVE ACCOUNT of a NEW METHOD of PLANTING and MANAGING the ROOTS of GRAPE

VINES. By Clement Hoare, author of a Treatise on the Cultivation of the Grape Vine on Open Walls. 5s.

THE ECCLESIASTICAL ARCHITECTURE of ITALY, from the time of Constantine to the Fifteenth Century; with Text by Henry Gally Knight, Esq., M.P. Second and concluding Series. Five guineas.

AN ESSAY upon the UNION of AGRICULTURE, with MANUFACTURES, and upon the Organisation of Industry. By Charles Bray. 1s.

THE ALPACA: its Naturalization in the British Isles considered as a National Benefit, and as an Object of immediate Utility to the Farmer and Manufacturer. By William Walton.

Periodicals.

The London, Edinburgh, and Dublin Philosophical Magazine. No. 159. 2s. 6d.

The Edinburgh New Philosophical Journal. No. 73. 7s. 6d.

The Civil Engineer and Architect's Journal. No. 83. 1s. 6d.

The London Journal (Newton's). No. 151. 2s. 6d.

The Repertory of Patent Inventions. Enlarged Series. No. 21. 3s.

The Glasgow Practical Mechanics' and Engineers' Magazine. Part 34. 8d.

The Artizan. No. XVIII. 1s.

The Builder. No. 75. 8d.

The Nautical Magazine. No. 18. Enlarged Series. 1s.

Pharmaceutical Journal and Transactions (Bell). 1s.

Annals and Magazine of Natural History, including Zoology, Botany, and Geology. By Sir William Jardine, Bart., P. J. Selby, Esq., Dr. Johnson, &c. No. 137. 2s. 6d.

The Zoologist. No. 19.

The Polytechnic Review. No. I. By Dr. Sigmond and Dr. Stone.

LIST OF ENGLISH PATENTS GRANTED BETWEEN JUNE 25, AND JULY 25, 1844.

Guy Carlton Coffin, of Lunaford, Wilts, esquire, for certain improvements applicable to locomotive, marine, and stationary engines. July 3; six months.

Anthony Lorimier, of Clerkenwell Close, Middlesex, bookbinder, for certain improvements in the apparatus and means of facilitating drawing from nature or models. July 3; six months.

Henry Smith, of Stamford, Lincolnshire, agricultural implement maker, for certain improvements in the construction and arrangement of hand-rakes and horse-rakes, and in machinery for cutting vegetable substances. July 3; six months.

Charles Nossiter, of Linden End, near Birmingham, tanner, for improvements in tanning hides and skins. July 3; six months.

John George Bodmer, of Manchester, engineer, for certain improvements in locomotive steam-engines, and in carriages to be used upon railways, in marine engines and vessels, and in the apparatus for propelling the same, and also in stationary engines, and in apparatus to be connected therewith. July 3; six months.

Christopher Dunkin Hays, of Bermondsey, Surrey, Wharfinger, for certain improvements in propelling vessels. July 3; six months.

Octavius Henry Smith, of Wimbledon, Surrey, esquire, for certain improvements in steam-engines, boilers, and condensers. July 3; six months.

Stephen Bencraft, of Barnstaple, esquire, for improvements in the construction and fitting up of harness for the prevention and cure of galled shoulders to draught horses. July 3; six months.

James George Newey, of Birmingham, hook and eye manufacturer, and James Newman, of the same place, jeweller, for improvements in fastenings for wearing apparel. July 3; six months.

Thomas Syson Cundy, of Cutler-street, builder, for certain improvements in the construction and arrangement of stoves and fire-places. July 3; six months.

Willoughby Theobald Monzani, of Wellington-terrace, Ramsgate, gentleman, for certain improvements in the construction of boats for the preservation of life and property, and in apparatus applicable thereto. July 3; six months.

Daniel Stafford, of Grantham, gentleman, for improvements in apparatus for preventing what is termed smoky chimneys or flues, and for the extinction of fire in chimneys or flues. July 3; six months.

Timothy Fisher, of Liverpool, mechanic, for improvements in locomotive engines. July 10; six months.

Moses Poole, of Serle-street, gentleman, for improvements in the manufacture of paper. (Being a communication.) July 10; six months.

Moses Poole, of Serle-street, gentleman, for improvements in the manufacture of oils, by using a material not hitherto employed, and in obtaining stearine therefrom, applicable in the making of candles, and also in the manufacture of manure from the residuum of such oils with other matters. (Being a communication.) July 10; six months.

William Bedington, jun., of Birmingham, manufacturer, for improvements in the construction of furnaces. July 10; six months.

Charles Henry Capper, of Birmingham, engineer, for a certain improvement, or certain improvements, in the manufacture of palisades, gates, and fences, the whole or part of which improvements may be applied to other purposes. July 10; six months.

William Newton, of Chancery-lane, Middlesex, civil engineer, for certain improvements in the manufacture of wire from zink, and the application of the same to various useful purposes. July 10; six months.

Henry Highton, of Rugby, Warwick, master of arts, clerk, for certain improvements in electric telegraphs. July 10; six months.

Robert Beart, of Godmanchester, Huntingdon, gentleman, for improvements in apparatus for boring in the earth and in stone. July 10; six months.

John McBride, manager of the Nursery spinning and weaving mills, Hutchesontown, Glasgow, for certain improvements in the machinery and apparatus for weaving by hand, steam, or other power. July 15; six months.

James Harrison, of Irwell House, Bury, Lancaster, manufacturer, for certain improvements in machinery or apparatus for spinning cotton and other fibrous substances. July 15; six months.

Henry Davies, of Norbury, Stafford, engineer, for improvements in the construction of certain steam-engines, also in the application of steam to such engines. July 15; six months.

William Taylor, of Regent-street, Middlesex, gentleman, F.L.S., for improvements in the manufacture of oil from a vegetable, not hitherto so used. July 15; six months.

Jacques Bidault, of Paris, merchant, for improvements in applying heat for generating steam, and for other purposes, which improvements may be employed to obtain power. (Being a communication.) July 17; six months.

Charles Armengaud, of Paris, engineer, for improvements in apparatus for heating apartments, and other places, and in apparatus for cooking. (Being a communication.) July 18; six months.

Henry Bewley, of Lower Sackville-street, Dublin, apothecary and chemist, and George Owen, of the same place, chemist, for improvements in the mode of confining corks, or substitutes for corks in bottles and other vessels, whether made of glass, earthen, or stone ware, containing liquids charged or not charged with gas. July 20; six months.

James Nield, of Taunton, in the State of Massachusetts, North America, for certain improvements in looms. July 24; six months.

Sarah Coote, of Clifton, near Bristol, Gloucester,

for improvements in caulking ships, boats, and other vessels. July 24; six months.

Charles Humfrey, of Cross-lane, Saint Mary at Hill, London, for improvements in the manufacture of candles. July 24; six months.

General George Wilson, of Cross-street, Islington, machinist, for certain improvements in the construction of chimneys and flues, and in furnaces, stoves, grates, or fire-places generally. July 24; six months.

William Brockedon, of Devonshire-place, Queen-square, gentleman, for improvements in covering the roofs of houses and other buildings, in covering the valves used when propelling by atmospheric pressure, in covering the sleepers of railways, and in covering parts of stringed and keyed musical instruments. July 24; six months.

Joseph Hall, of Bloomfield, iron works, Tipton, Stafford, ironmaster, for improvements in the manufacture of horse-shoe nails. July 24; six months.

John James Russell, and Thomas Henry Russell, both of Wednesbury, Stafford, tube manufacturers, for improvements in the manufacture of welded iron tubes. July 24; six months.

James Kite, of Hoxton, coal-merchant, for certain improvements in constructing chimneys, and in the means used for sweeping the same, parts of which improvements are applicable to other like useful purposes. July 24; six months.

Edmund Pace, of the firm of Messrs. Taylor and Pace, of Hackney, in the county of Middlesex, gentleman, for improvements in the machinery for figure weaving in silk, and other fabrics. July 24; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22ND OF JUNE TO THE 22ND OF JULY, 1844.

James Kennedy, of the firm of Bury, Curtis, and Kennedy, of Liverpool, Lancaster, engineer, and Thomas Vernon, of the same place, iron ship builder, for certain improvements in the building or construction of iron and other vessels for navigation on water. Sealed June 24.

Charles William Graham, of King's Arms-yard, in the city of London, merchant, for improvements in manufacturing pathological, anatomical, zoological, geological, botanical, and mineralogical representations in relief, and in arranging them for use. (Being a communication from abroad.) June 24.

Walter Frederick Campbell, of Islay, Argyle, Scotland, esquire, for an improved rotatory engine, to be driven by steam or other power. June 25.

Robert Poulerton, of the Jamaica Coffee House, Cornhill, in the city of London, master mariner, for improved machinery for mooring vessels and other floating apparatus. June 25.

Thomas Hancock, of Goswell Mews, Goswell-road, Middlesex, waterproof cloth manufacturer, for an improvement or improvements in the preparation or manufacture of caoutchouc in combination with other substances, which preparation of manufacture is suitable for rendering leather, cloth, and other fabrics waterproof, and to various other purposes for which caoutchouc is employed. June 25.

Edmund Morewood, of Thornbridge, Derby, merchant, and George Rogers, of Stearndale, in the same county, gentleman, for improvements in coating iron with other metals. June 27.

George Wilson, of St. Martin's-court, St. Martin's-lane, Middlesex, stationer, for improvements in the cutting of paper for the manufacture of envelopes, and for other purposes. June 27.

Robert Dawson, of Brick-lane, Middlesex, civil engineer, and William Symington, of East Smithfield, Middlesex, civil engineer, for a method or methods of drying, seasoning, purifying, and hardening wood and other articles, either in a manufactured or unmanufactured state, parts of which are applicable to the preparation and desiccation of animal, vegetable, and mineral substances. July 1.

William Brockedon, of Devonshire-street, Queen-square, Middlesex, gentleman, for improvements in the manufacture of pills and medicated lozenges, and in preparing or treating black lead. July 2.

George Edmund Donisthorpe, of Bradford, York, for improvements in combing wool and other fibrous substances. July 8.

John McBride, manager of the Nursery spinning and weaving mills, Hutchesontown, Glasgow, for certain improvements in the machinery and apparatus for weaving by hand, steam, or other power. July 9.

Moses Poole, of the Patent Office, Searle-street, Middlesex, gentleman, for improvements in the manufacture of paper. (Being a communication from abroad.) July 11.

George Miller Clarke, of Albany-street, Regent's Park, Middlesex, tallow-chandler, for improvements in night lights, and apparatus used therewith. July 11.

William Henry Phillips, of Bloomsbury-square, Middlesex, engineer, for certain improvements in the means and apparatus for subduing and extinguishing fire, and saving life and property, and in obtaining and applying motive power, and improvements in propelling. July 15.

Edward Buxton, of Basinghall-street, in the city of London, merchant, for improvements in spinning wool, cotton, and other fibrous substances. (Being a communication from abroad.) July 15.

George Gwynne, of Princes-street, Cavendish-square, gentleman, and George Fergusson, of Belmont, Vauxhall, Surrey, gentleman, improvements in treating certain fatty or oily matters, and in the manufacture of candles and soap. July 22.

NOTES AND NOTICES.

French Law of Patents.—The important change in the patent law of France, which we some time ago announced as being in contemplation, has been finally approved of by the King and Chambers, and will come into full operation on the 8th of October next. We heartily congratulate the mechanical and manufacturing interests of France on this auspicious event; and are not without hopes that it may have the effect, ere long, of inducing a similar change in the patent law of our own country. Instead of an inventor being required to pay down the whole cost of a patent in the first instance (as with us), he may pay it by instalments of 100 francs annually, and may at any time throw up the patent, and cease his annual payments. Foreigners, too, are, equally with natives, to be entitled to the benefit of the new law.

An Old Scandal Revived.—The following passage from one of Latimer's sermons proves that "Devil's dust" was an ingredient as familiar to the manufacturers of the 16th as to those of the 19th century. It was denounced, however, from a different tribunal:—"I hear say there is a certain cunning come up in the mixing of wares. How say you: were it not a wonder to hear that the cloth-makers should become 'poticaries? Yea, and I hear say in such a place, whereas they have professed the gospel and the word of God most earnestly of a long time. See how busy the Devil is to slander the word of God. Thus the poor Gospel goeth to wrack. . . . If his cloth be 17 yards long he will set him on a rack, and stretch him out with ropes, and rack him till the sinews shrink again whilst he hath brought him to 18 yards. When they have brought him to that perfection, they have a pretty feat to thick him again. He makes me a powder for it, and plays the 'poticary; they call it flock powder. . . . They were wont to make beds of flocks, and it was a good bed too; now they have turned the flocks to powder, and play the false thieves with it. O wicked

Devil! what can he not invent to blaspheme God's word? Wo worth that these flocks should slander the word of God! As he said to the Jews, thy wine is mingled with water, so might he have said to us of this land, thy cloth is mingled with flock powder."

A Crooked Building made Straight.—We have much pleasure in bringing to the notice of our readers a successful application of science in restoring to a perpendicular position the north wall of Market Weston Church, in this county. The church is supposed to have been erected in the 14th century. In 1630 it was injured by lightning, and again 10 years since it was much shattered by a thunder-storm. The time had now arrived when it became necessary to effect a perfect restoration, as from age and the above-mentioned casualties the north wall had declined outwardly 19 inches from the perpendicular, and threatened the utter destruction of the building. Under the superintendence of our able architect, Mr. Cottingham, this wall (the weight of which had been calculated at 240 tons) has been brought up to the perpendicular, by the process of expanding by heat three bars of iron, 2½ inches in diameter, which traversed and connected both walls of the church. These bars (which had screws worked on one end of them and projected beyond the south wall) were enclosed in cast-iron boxes filled with lighted charcoal. When the bars were fully expanded by the heat, the screws were wound up firmly to the undamaged south wall. The charcoal boxes were then removed, and the process of cooling commenced. Gradually the bars contracting equally with their previous expansion, compelled the whole mass of the wall to follow the irresistible power now exerting itself, and in four successive operations the whole wall rose to its original perpendicular. The whole operation does infinite credit to Mr. Cottingham. Much commendation is also due to Mr. Reed, of Ixworth, who so ably followed out his directions, as well as to the zealous intelligent workmen who brought to a successful termination this beautiful but simple process. Several of the surrounding families assembled at Weston Church, on Monday last, to witness the completion of this novel operation, the only instance of which has been, we understand, at the Cathedral of Armagh, under the superintendence of the same architect.—*Bury Post.*—[We believe this plan of restoration was first adopted on the Continent a good many years ago. It is fully described by Baron Charles Dupin, in his "Mechanical Geometry."—ED. M. M.]

Four-wheeled and Six-wheeled Engines.—From the commencement of the present year, there were in operation, in the United Kingdom, 2,113¾ miles of railway, about 120 miles of which had only one track of rails, and about 230 miles were worked by stationary engines or horse power. The remaining miles were worked exclusively by locomotives, and, from the latest return, by four-wheeled engines over 224 miles, and six-wheeled over 605 miles.

Effectual Method of Preserving Furs, &c., from the Ravages of Moths.—Wash the fur on both sides with a mixture of corrosive sublimate, dissolved in half-a-pint of spirits of wine. To make it dissolve more readily, the corrosive sublimate should be reduced to powder in a marble mortar. If moths have harboured in the lining wool of muffs, it must be replaced by new wool, that has been well saturated with the above preparation. The mixture is colourless, and will not injure the most delicate fur, feathers, or woollen articles of any kind.

Preparation of a Beautiful Green Colour without Arsenic.—48 lbs. of sulphate of copper, and 2 lbs. of bichromate of potash are dissolved in the requisite quantity of water, and 2 lbs. of carbonate of potash (pearlash) and 1 lb. of chalk added to the clear solution. The precipitate is pressed, dried, and rubbed to a powder. This colour is not so beautiful as the Schweinfurth green, but is peculiarly well adapted for painting dwelling-rooms and workshops, there being no fear of any poisoning from arsenic. By varying the proportions, a number of different tints of this colour may be obtained.—*Bittheilungen des Böhm. Gewerbevereins.*

Railway Accidents.—The report of the railway department of the Board of Trade for the past year shows that the number of railway accidents has so much decreased as to have become almost inappreciable. In 1840 it is estimated, by doubling the last five months, that there were 56 accidents, by which 44 persons were killed and 262 hurt; in 1841, there were 29 accidents, killing 25 and hurting 72 persons; in 1842, 10 accidents, by which 5 persons were killed and 14 hurt; and in 1843, only 5 accidents, and 3 persons killed and 3 hurt, out of perhaps 3,000,000 of passengers.

The Atmosphere.—M. Andraud, an engineer, who has devoted some years and large sums of money to experiments on atmospheric air with a view to its application to navigation and railroads, states that by looking through a hole of very small diameter, the molecules of atmospheric air may be clearly distinguished. The molecules of oxygen and azote are, he says, very different in size, form, and general appearance.—*Athenæum.*

American Scraps.—The South America, steamer, has made the passage from New York to Albany, 160 miles, in 7h. 59m. making 13 landings, which occupied 55 minutes, and reduced the running time to rather more than 7 hours!——The boats between New York and Albany are carrying passengers at 50 cents per head.——A Captain Loper, of Philadelphia, has made an improvement on the Ericsson propeller. Wrought iron fans are used instead of cast-iron ones, thereby insuring greater permanency to the paddles. Eight miles an hour is the average speed.——The proprietor of the machine for hatching eggs in New York, has procured an alligator's egg from the South, from which he announces that a young one may be expected in a few weeks.——140 tons of pig-iron are melted daily, at Pittsburgh, and converted into all the varieties of wrought and cast iron. ——Mr. Faber, the ingenious inventor of the talking-machine, at Philadelphia, totally destroyed it the other day, in a fit of temporary derangement. ——The common Waltham sheetings in 1816, sold at 30 cents, are now offered at 8½ cents.——The great Fravenhofer Telescope, together with the transit instrument and comet seeker, made at Munich, under the orders of Lieut. Gillis, have arrived safely at their destination, and are already in progress of erection at the Astronomical Observatory and Naval depot.——Messrs. Thornton, Jewett, & Co., from Leeds, England, have just started a woollen manufactory, on Six Mile Creek, near Erie, Pa.——Dr. Lardner is exhibiting a microscope in Charleston, South Carolina, which possesses wonderful magnifying powers. A flea seen under the highest of these powers appears to be about 40 feet in length.——A Pittsburgh company are about to work the copper mines near Lake Superior.——Some very valuable zink mines have been discovered by a German at Warren, in N.H.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1095.] SATURDAY, AUGUST 3, 1844. [Price 3*d.*

Edited by J. C. Robertson, No. 166, Fleet-street.

WARD AND COLBOURNE'S CHAFF-CUTTING ENGINE.

Fig. 1.

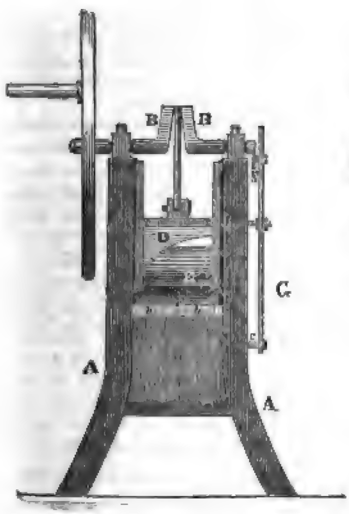


Fig. 2.

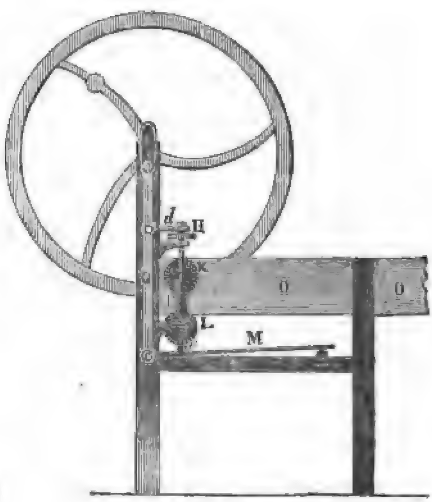
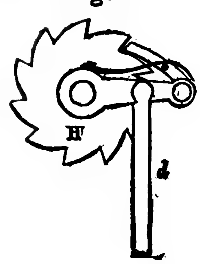


Fig. 3.



WARD AND COLBOURNE'S CHAFF-CUTTING ENGINE.

[Registered under the Act for the Protection of Articles of Utility. James Ward, Agricultural Implement Maker, and William Colbourne, Ironmonger, both of Stratford-upon-Avon, in the County of Warwick, Proprietors.]

We gave last week a description of a cutting engine of the *patent* class, and have now to describe one which, though *registered* only, is certainly by no means inferior either in point of originality or usefulness.

Fig. 1 is an end view, and fig. 2 a side view of the engine.

A A is the frame; B B the crank by means of which an up and down motion is given to an iron frame C C, to which the knife or cutter D is screwed or otherwise attached; *a a* guide bars for preserving the parallelism of the knife frame; E F, rollers for bringing forward the straw or other material on to *b b*, two steel plates, which are placed so close to each other as only to leave room for the cutter to pass between them; G is a lever working at the lower end upon a pin *e*; this lever has a slot at the upper end, through which a screw is passed into a smaller crank N, on the end of the crank shaft in fig. 1. *d* is a connecting rod attached to a spring ratchet wheel (shown on an enlarged scale at fig. 3). The lever G being made to move backwards and forwards by turning the crank, causes the ratchet wheel H to revolve. I is a pinion roller connected by a shaft to the ratchet wheel, from which it receives motion, and causes the two crown wheels K and L to turn, and also the two rollers E and F, which are connected to the wheels K and L, which rollers bring forward the straw on to the steel plates, *b b*, ready to be cut. The pinion roller, I, is made of such length as to allow of a large or small thickness of straw or other material to pass between the rollers E and F, and still act upon the wheels to which they are connected.

In the small crank N there are three holes for the reception of the screw, which connects the lever G, for the purpose of regulating the length of straw or other material required to be brought forward. M is a weighted lever, to which is connected a rod *f*, passing over the axle of the upper crown wheel K, for pressing the straw between the two rollers. O O is the trough for holding the straw or other material.

WEALE'S QUARTERLY PAPERS ON ENGINEERING—PART IV., MIDSUMMER, 1844.

I. *On Havens of Safety—By James Vetch, Captain R.E., F.R.S.*

This is a sequel to the paper on the same subject, by Captain Vetch, which appeared in the January part. Having already shown the advantages which, in the judgment of the writer, would result from the employment of skeleton framings of wrought iron in the construction of breakwaters on such precipitous and exposed shores as occur in the Isle of Thanet, Captain Vetch now applies himself to demonstrate that the same mode of construction may be usefully followed in the conversion of sunken sand-banks, into breakwaters or dry banks, and selects for his great example the celebrated Godwin Sands. The following description of these sands, drawn up by Captain Vetch, chiefly from personal observation, is probably the most correct which has ever yet appeared.

"The Godwin Bank is of an oval, or rather egg-shape, the extreme length, measured from the three fathom level at the north sand head to the same level at the south sand head, being 17,980 yards, or 10¼ statute miles nearly, and the extreme breadth from the west excrescence at the Bunt Head to the Barrier Edge, being 7667 yards, or somewhat better than 4¼ statute miles.

"The extent of the portion of the bank which is left dry in spots at low water is 12,364 yards long, and 6,532 yards broad, that is, about seven statute miles by $3\frac{7}{10}$, or 3·7.

"The elevated spots inclosed within the last dimensions, at ordinary spring tides, are left dry at low water to the amount of 3½ to 5½ feet; average 4½ feet; and at these times their surfaces remain dry and workable upon, for three hours, and the rise and fall of tide being 16½ feet, these spots are covered, on the average, at high water to the extent of 12 feet.

"The nature of the sand is remarkably clean and free from clay and mud, as might naturally be expected from the constant washing to which it is exposed, and Mr. Smeaton, who landed upon the bank in May, 1789, states that he 'visited and landed upon the Godwin Sands to have a view of them, and examine their nature, and found that though of the nature of a quicksand, clean and unconnected, yet the particles lay so close that it was difficult to work a pointed iron bar into the mass more than to the depth of six or seven feet.'

"Captain Bullock, who made a boring lately, found at the depth of 7½ feet the sand become so dense and cohesive as to break the borer in the efforts to make it penetrate lower, and it is stated that Captain Hewett was unable to bore to a greater depth than 8 feet.

"It is very generally believed that the Godwin Sands rest, at a depth of 30 feet, or thereabouts, on a bed of chalk; but such a fact does not appear to have been ascertained by satisfactory borings, and in the absence of direct proof, it is to be presumed, on inferential grounds, that such is not the case.

"The middle of the Godwin Sand lies opposite the town of Sandwich, the south end opposite to Deal, and the north end to Ramsgate, fronting generally what is at present Sandwich Bay, but what was formerly the mouth of a wide navigable channel, separating the Isle of Thanet from the mainland, and called the Wantsum Creek. The channel which separates the Godwin Sand from the Kentish shore is four statute miles wide at Deal, and five near Ramsgate, and through this channel flows the Gull stream, the depth of which is greatest about a quarter of a mile from the bank, where it averages about nine fathoms, while on the outer, or east side of the bank, the depth of water at half a mile distant is 16 fathoms, and at two miles distant 30 fathoms, being there the main channel of the tide currents that set through the straits of Dover, and exhibiting the greatest soundings between the English and French coasts on that line of section."

The well-known popular tradition as to the origin of these sands is considered to be without foundation.

"As it is a common belief that the Godwin Sands are part of a submerged estate of the celebrated Earl Godwin, it may be of use to remove that belief, because if the locality was once firm land, which was unable to resist the undermining influence of the waves, such a circumstance would prove an argument against the probability of regaining what could not be maintained. Earl Godwin died 15 April, 1053, and the following remarks are quoted from Hasted's Account of the County of Kent.

"'The commonly-received story of the sands opposite Deal, called the Godwynes, and supposed to be so called from their having been once the estate of this earl, and a great judgment for his crimes, (at once swallowed up by the sea,) has been exploded, as well as that of their having been an island called Somes. The most probable opinion of our best antiquaries being, that instead of the sands being occasioned by an inundation of the sea, they were rather caused by the sea leaving them in the reign of William Rufus, (about A.D. 1090,) at the time of the terrible inundations which drowned so great a part of Flanders and the Low Countries, by which the low part of the channel, which had before sufficient quantity of water at all times to cover it, (the channel being as navigable there as elsewhere,) became a large tract of land, dry at low water, and but insufficiently covered by the waves at other times, and as such, of the most dangerous consequence to mariners, as the continued shipwrecks upon it sufficiently prove.'

"From the above we are to infer that the Godwin Sands had increased to such a degree in the time of King Rufus as then, for the first time, to have become an object of danger and solicitude to shipping; it is not, however, very easy to see what the inundations in Holland had to do with the increase of the Godwin Sands, unless it be conceived that a subsidence of the land at the former place was compensated by an elevation at the latter, a geological doctrine that had not received attention in those days; but we have no evidence of the elevation of the shores opposite to the Godwin, (except the filling up of the Wantsum Creek,) but if the adjoining part of the coast had been uplifted two or three fathoms, the evidence would have existed in the occurrence of raised sea-beaches, a fact which the author has not detected on that part of the coast."

The effects anticipated by Captain Vetch from converting the Godwin Sands into a dry bank, or island, are these:—

"1st. A dangerous indraft to shipping would be removed, and vessels might then hug the lee side in safety and take shelter there, instead of fearing to go near it, as is now the case, and with ample reason, and thus a dangerous shoal would be converted into a friendly shore.

"2dly, A constant and effectual breakwater would be provided for the anchorage of the Downs from north-east to south-east.

"3dly. Room and facility would be given for the deposit of a vast quantity of sullage, where it would prove highly beneficial, and

the same matter would be prevented settling where it would most probably prove injurious.

"4thly. The elevated surface of the bank would afford the means of erecting with facility beacons, lighthouses and batteries, and other useful erections.

"5thly. So much surface would ultimately be reclaimed as might tend to some extent to repay the cost of the works. Thus, for instance, if after fixing a spinal embankment on the Godwin Sands, the operations of nature went to the extent anticipated by the writer, a space of ground 6¾ statute miles long by three wide would be reclaimed, containing an area of about 8,640 acres."

Captain Vetch proposes to conduct his "spinal embankment" along the sand-bank in such a manner that the tidal waters should continue to visit both sides of it, and deposit there the solid matters contained in them.

"It is proposed to carry the spine or nucleus breakwater parallel to the great crest of the sands, as particularly developed along the eastern margin of the bank, and at the average distance of 500 yards from the edge, that the artificial barrier may be secure from damage by any temporary shifting of the outline of the bank, and also that sufficient space may be left outside the spinal embankment for the deposit of matter, which being sustained in reverse, would not be so subject to be carried off by currents or storms as at present, and would afford mutual support to the spine.

"Besides carrying the spine round the east and north edges of the Godwin Sands, it might be proper to continue it partly down the west side towards the Bunt Head, for the purpose of securing a compact and well-rounded outline to the sands on that side, which is now so liable to shift.

"The above disposition would serve to enclose the sands along three-fourths of their periphery, leaving open one quarter on the south-west side for the tide to flow in and make deposits; and it so happens, from the deep water of the quarter left open, that its inclosure would have been impracticable at any reasonable cost; but were it otherwise, it would have been equally necessary to have left open that fourth part of the circumference, for reasons already assigned.

"The space thus proposed to be left open constitutes the mouth of Trinity Bay, which, the writer is inclined to believe, will, after the construction of the barrier, silt up, and that the resulting dry bank or island will attain a compact rounded or egg-shape."

The embankment would be formed in the following manner :—

"To meet the condition of the Godwin Sands in constructing the spinal embankment, it is proposed to use iron rods, in a position nearly vertical, penetrating 7½ feet into the sands and rising 7½ feet above their surface; the upright rods to be about 1 foot apart, and arranged in square frames of 12 feet each side; and these squares complete, (called iron gabions, for facility of description,) will each contain 48 iron rods on a space of 12 feet square, penetrating the sand 7½ feet, and considering what has been stated of the tenacity or closeness of the sands at that depth, it may safely be allowed that so great a number of prongs will give the gabion all the strength that can be required against any lateral force applied above the level of the sands, and so far from seeking to go deeper for a foundation, it might be better to employ means to prevent any farther settlement of the gabions.

"The iron gabion being fixed, and the rods inserted in the sand to the depth stated, it is next proposed to floor the interior space with hurdles, and on these to line the gabion with one row of fascines firmly fastened to the iron rods; and this first stage of the structure to remain, without further addition, until the action of the sea has heaped up the sand externally and internally to the top of the fascines, when a second floor of hurdles and second row of fascines will be introduced, and the operations continued until the gabion is filled.

"The gabions now described form but the first tier in the structure, and when the interior and exterior surface has become elevated 7 feet, a second tier of gabions is to be keyed on to the first, and these last treated as the first.

"In the foregoing manner the author merely attempts to raise a barrier 1 foot high at a time, and composed of materials not offering a solid resistance to the waves, but calculated to receive and retain the sand on either side as thrown up.

"It will be obvious that on such a surface as that of the Godwin Sands, and where we cannot safely plant a heavy structure or acquire a solid foundation, that we must endeavour to supply these deficiencies by embracing and holding on by as broad a surface as can conveniently, and economically be attempted; and with this principle in view, it is proposed on the line of spinal embankment to lay down two parallel rows of gabions 36 feet apart, bonded and tied together with cross rows at every 36 feet, by which means a base 60 feet wide would be procured for the spinal embankment, and

by the numerous cells of which it is composed, every facility would be offered for the accumulation and retention of sand, &c., an object which would be still farther attained by throwing out ribs from the spine at suitable points to intercept the passing sedimentary materials, and these ribs embracing the sand to a still greater extent of surface, would increase the stability of the spine.

"The ends or termini of the spinal embankment may be secured by bending them round in the form of a half circle, or even by an entire circle or loop, and these returns at the extremities would help to accumulate matter there."

The whole of these arrangements are exceedingly judicious, and we share in the author's confidence that *if* they could be carried out they would, in no great length of time, effectually accomplish the desired object. One very essential thing, however, he has quite overlooked, or at least only slightly touched upon, and that is, *the means by which his squares of iron rods are to be sunk*. He speaks in a note at the end of his paper, of "letting each upright rod *find its way* separately into the sand bank;" but if the Godwin Sands are never to be reclaimed, except on such a system of spontaneous pile-sinking as this, we may safely reckon on their remaining for ever under the dominion of the sea. The notion is too idle for serious reflection. Captain Vetch had probably not heard at the date of writing his paper, of Dr. Pott's recently patented, and most ingenious and philosophical plan of forming submarine foundations of *hollow piles*, sunk by the *process of atmospheric exhaustion*. For the solid rods of Captain Vetch let the hollow piles of Dr. Potts be substituted, and the scheme of converting the Godwin Sands into high and solid land becomes one of the utmost feasibility.

Captain Vetch estimates that the entire expense would not exceed 506,880*l.*, which is less than the value of the property engulphed by these sands in the course of every two or three years.

Captain Vetch's paper contains also a plan for a harbour of refuge, to be formed by the embankment of Sandwich flats—the formation of a breakwater on the Break Bank (opposite to Sandwich Bay)—the erection of a pier on the Quern (opposite Ramsgate)—and the raising of a pier and screen on the Deal sand-bank.

"The above-named works would complete a harbour of refuge, which would, in fact, become the port of three towns, Deal, Sandwich and Ramsgate, extending more than seven miles in length, and two in breadth, with an area of about 10,000 acres, whereof one-fourth part, or about 2500 acres, has at present a depth of from four to six fathoms at low water; and though the remainder is at present comparatively shallow, such would no longer be the case when the channels and currents were improved by the proposed works. The haven would be provided with four entrances: two at the north end on either side of the Quern of 1000 and 1300 yards wide respectively; and two at the south end, viz.: one at Deal 1200 yards wide, and the main entrance at the Hook, one statute mile wide."

The expense of this harbour of refuge is estimated at 725,000*l.*, exclusive of the embankment of the Sandwich flats, which it is reasonably supposed would "repay the cost by the virtue of the land reclaimed."

The paper is illustrated by a map, and several plates, and is altogether a very able and (with the single exception to which we have adverted) well-conceived production.

II. *Report on the Holyhead and Port Dynllaen Harbours. By Sir John Rennie.*

If it be a disadvantage, in so far as originality is concerned, to come after everybody else to the consideration of a subject, it is attended with this obvious advantage on the other hand, that it affords to a writer the means of taking larger and more comprehensive, and probably, therefore, juster views of it. Sir John Rennie is in this position precisely. His Report is dated no further back than the 30th March last, prior to which period the comparative merits of Holyhead and Port Dynllaen, as points of communication with Ireland, had been discussed in books, and pamphlets, and newspapers, *usque ad nauseam*. Opportunity, therefore, to contribute much that was new in point of fact, or even, perhaps, in argument, there was none; the utmost that was left for him to do was to furnish a good

review of the labours of others. And this is what Sir John Rennie has done. He has arranged and classed the various facts bearing on the subject with great distinctness and clearness; examined the deductions drawn from them by the contending parties, keenly, yet dispassionately; and without concealing his own leanings, has furnished every one with the means of judging for himself, which of the two ports ought to be preferred. Sir John Rennie himself would prefer Port Dynllaen—differing in this from Mr. Walker and the Government commissioners, Sir James Gordon and Captain Beechey. One of Mr. Walker's arguments against Port Dynllaen is thus cleverly turned against him:—

"Port Dynllaen has been resorted to as a port of refuge for shipping, even in its natural state, by numerous fleets of shipping. In 1807, Mr. Thomas Rogers, an engineer of some repute, proposed to construct an asylum harbour there, and to make it the principal packet station to communicate with Dublin, instead of Holyhead; and it appears from the Custom House returns that the following number of vessels took refuge there:—

	At Port Dynllaen.	At Holyhead.
In 1840	722	1121
1841	769	1142
1842	914	940
1843	900	
Total....	3315 in the 4 last years.	

"Mr. Walker observes, 'That there is no shop or store of any kind nearer than Edern, one mile, nor is there the appearance of there having been one; a proof that if on occasions a great number of ships have taken advantage of the harbour, these occasions have not been frequent, or the ships must have remained a very short time;' but the above statement shows that, notwithstanding the absence of all such accommodation, and that the harbour in other respects is quite in a state of nature, nearly as many vessels have taken refuge there as at Holyhead.

"If, therefore, such a number of vessels take refuge there even in its present state, *it is but reasonable to conclude that, if more protection and greater facilities were given, the number of vessels seeking shelter there would be much increased.*"

Mr. Walker having observed that Holyhead harbour, as he proposes to improve it, "would be less in point of area than Kingstown (designed by the late Mr. Rennie), but would be superior in point of accommodation for steamers, and would possess the advantage of an entrance protected against all winds, which Kingstown does not"—this observation draws from Sir John the following indignant vindication of his father's plans with respect to the harbour alluded to:—

"With regard to Mr. Walker's observation upon the entrance of Kingstown harbour, it is one of the great merits of that magnificent design of the late Mr. Rennie, that the entrance is open to the dangerous wind when the Irish coast becomes a lee-shore, and when a harbour is most wanted, in order that any vessel, however disabled, even only floating and driving before the gale, should be able to enter without difficulty; in fact she could not miss the entrance; and by the particular form of the pier no swell of any consequence could enter the harbour, and any swell which might enter would have ample room to expend itself, without creating any injurious undulation or agitation within. In the same manner, any vessel under sail could get out in any wind, when prudent to put to sea. Thus the grand and difficult problem of making a refuge-harbour, easy of entrance and departure, and tranquil within, would have been solved, had Mr. Rennie's plan been wholly carried into effect; but unfortunately this has not been done, and the piers have been stopped at the very point where they ought to have been continued. The old harbour of Dunleary, with its flat shelving beach, (which was expressly included within the west pier, for the purpose of enabling any swell which might pass the entrance during easterly storms to expend itself without recoil,) has been allowed to be blocked up by a solid embankment of the Kingstown Railway, which might just as well have been carried upon archways, or have avoided the harbour entirely; and a new solid granite perpendicular wharf wall has been built out in the centre of the harbour opposite to the entrance, considerably beyond high-water mark, where, if anything, the shore already projected too much, and it would have been better to have reduced it. Thus, the sea during easterly gales rolls on uninterrupted through the present defective and injudicious entrance, strikes against and rebounds from the centre landing wharf and railway embankment, and creates such a swell in the harbour, that vessels cannot lie in safety; and as a melancholy illustration of the above, no less than eight or ten vessels were driven ashore and wrecked in the har-

bour during the severe easterly gale of the 16th instant; which could not have occurred if the harbour had been finished as designed by the late Mr. Rennie; and this is the more to be regretted, because these evils were anticipated, and pointed out expressly previously to the objectionable works being carried into effect. So far, therefore, from the entrance of the proposed harbour at Holyhead, as designed by Mr. Walker, being an advantage, it is a great defect, and if proceeded with, would render the harbour comparatively useless as an asylum at those times when it ought to be most available."

III. *An Investigation of the Comparative Loss by Friction on Beam and Direct-action Steam-engines. By William Pole, F.R.A.S., F.G.S., &c.*

The substance of this paper, which was read before the Institution of Civil Engineers, Feb. 7, 1843, has already appeared in our pages. Mr. Pole, it may be remembered, demonstrates 1st, that, as far as the friction from strain is concerned, the direct-action engine, as generally constructed, has rather the advantage than the disadvantage, when compared with the beam-engine, and that, even in its most unfavourable shape, the disadvantage is trifling. And 2nd, That as to the friction from other causes, there is no reason why it should be greater in the direct-action, though it *may be less*, than in the beam engine.

IV. *The Engineering of Holland. By Hyde Clarke, C.E.*

A very useful compilation from Dutch, German, and French writers, illustrated by some capital plates; preceded by an historical retrospect of the connexion between this country and the Netherlands, which might also have been useful, if it had contained less of the writer's *own*, for his own reminds us of the Spanish proverb, that though a blind man do mount on stilts, he can see but a little way.

V. *A Review of the Circumstances which have affected the Consumption of Fuel in the Locomotive Engines of the Liverpool and Manchester Railway, from the Opening to the present time. By Edward Woods, C.E.*

This is an excellent practical paper—probably the very best with which Mr. Weale's quarterly budget has yet furnished us. The importance of the inquiry to which it is devoted, is sufficiently attested by the simple fact, that it has for its object to give the why and wherefore, of the consumption of fuel on the Liverpool and Manchester line, having been reduced (with an increase rather than reduction of traffic) from 12604 tons in 1838 to 3103 (!) in 1843. Mainly, this has been owing to a progressive increase from $\frac{1}{16}$ inch to 1 inch in the extent of the *lap* (as it is technically called) or space by which the sliding valve overlaps at each end the steam ports (when placed exactly over them), and to the greater rapidity with which the waste or used steam is thus enabled to escape from behind the piston. The *rationale* of this result is made exceedingly clear in the following extract:—

"Alternately to fill and empty the cylinder of its contents, are operations requiring *time*. The time allowed for the first operation, that of filling the cylinder with steam, necessarily corresponds with the duration of the stroke, whatever its duration may be. But this cannot be the case as regards the second operation, the emptying of the cylinder. This ought to be performed in an instant, in the twinkling of an eye, in the minutest fraction of the duration of the stroke, otherwise the steam would continue pent up when it ought to be liberated,—when it ought to assume its minimum pressure, the pressure of the atmosphere,—and would exert an injurious counter pressure against the piston, tending to increase the resistance to be overcome.

"To effect the free and rapid discharge, it is necessary, not merely to open the communication to the exhausting pipe, but to open a *wide* passage, and to have this *done* by the time the piston recommences its motion. The valve alluded to (the old one used until 1838) cannot accomplish this. Its motion is gradual, not instantaneous. The passage only begins to open when the piston is on the turn, and is not wide open until the piston has travelled through one-tenth of its entire stroke. The steam in the cylinder is consequently restrained from escaping, being wiredrawn in the passage out, and consequently takes *considerable time* to assume the pressure of the atmosphere.

"In the meanwhile the new stroke has begun, and been partially completed, and

so far the piston has had to contend with a resistance altogether illegitimate, a resistance which in many cases, and especially at high speeds, has been equal to the sum of all the other resistances put together."

The merit of first getting rid of this illegitimate resistance is ascribed to Mr. Dewrance, of the Liverpool and Manchester line :—

"The next important improvement in the valves is due to Mr. Dewrance, and was suggested by him early in the year 1840. His principle was, that the exhausting passage, instead of being only partially open at the moment of completing the stroke, as was more or less the case with the engines before-named, should be nearly wide open, which was to be accomplished by making the 'lap' of the valve equal to the width of the steam port ;—moreover, that the travel of the valve should be made proportionate to the increased lap, so as to allow the same area or the same amount of opening of the steam port for the admission of steam. A favourable opportunity occurred for carrying out these ideas, both as regarded increased lap and increased travel, from the circumstance of two engines requiring extensive repairs, which would allow time for the needful alterations. One inch lap was given to the *Rapid's* valve, which was now made to travel 4½ inches. The result of this arrangement was, that the exhausting passage was 1 inch open at the end of the stroke, and that, supposing the stroke of the piston divided into 100 equal parts, the steam was cut off at 79 ; it expanded from 79 to 95 ; at 95 it began to be released, and was escaping into the atmosphere from 95 to 100. The *Rapid's gross* average consumption of coke, when running sixty-four trips of 30 miles each with coach trains, *before* the alteration, was 36·3 lbs. per mile ; and 28·6 lbs. per mile immediately *after* the alteration. Thus we have a measure of the effect produced—*a saving of one-fourth of the fuel.*"

Mr. Wood gives the following valuable summary of the work done, coke consumed, and loads carried by the several classes of engines on this line for the last four years. It deserves, and, we doubt not, will receive the earnest attention of all other railway companies.

GROSS CONSUMPTION OF COKE.

PASSENGER ENGINES.

						COKE. Tons.	cwt.	qrs.	Per mile.
Half-year ending	June,	1840 ..	3463	Trips, 30 miles.	Average loads, 7 Coaches.	1523	16	3	=32·9 lbs.
	December,	,, ..	3596	,,		1276	9	1	=26·5
	June,	1841 ..	3493	,,		1036	15	3	=22·1
	December,	,, ..	3496	,,		958	19	0	=20·5
	June,	1842 ..	3655	,,		853	3	3	=17·4
	December,	,, ..	3526	,,		684	9	2	=14·5
	June,	1843 ..	3243	,,		646	1	1	=14·9
	December,	,, ..	3555	,,		717	2	2	=15·1

LUGGAGE ENGINES.

Half-year ending	June,	1840 ..	1925	,,	Average loads, 22 Wagons.	1160	12	3	=45·0 lbs.
	December,	,, ..	1653	,,		867	9	3	=39·2
	June,	1841 ..	1640	,,		749	0	1	=34·1
	December,	,, ..	1370	,,		531	17	1	=29·0
	June,	1842 ..	1604	,,		559	2	2	=26·0
	December,	,, ..	1521	,,		421	17	2	=20·7
	June,	1843 ..	1588	,,		441	7	2	=20·7
	December,	,, ..	1605	,,		451	12	2	=21·0

BANK ENGINES.

Half-year ending	June,	1840 ..	349	Days.	486	11	3
	December,	,, ..	356¼	,,	369	10	0
	June,	1841 ..	349½	,,	343	3	2
	December,	,, ..	341¾	,,	251	11	0
	June,	1842 ..	361	,,	174	6	3
	December,	,, ..	363½	,,	143	13	3
	June,	1843 ..	452¼	,,	162	8	3
	December,	,, ..	517¾	,,	183	12	2

COAL AND BALLAST ENGINES.

						Tons.	cwt.	qrs.	
Half-year ending	June,	1840	..	436¼	Days.	489	4	0	Average load, 15 Wagons.
	December,	,,	..	370	,,	344	17	3	
	June,	1841	..	334	,,	325	4	2	
	December,	,,	..	351¾	,,	312	4	2	
	June,	1842	..	407	,,	313	3	2	
	December,	,,	..	443¾	,,	243	3	3	
	June,	1843	..	306¼	,,	226	5	0	
	December,	,,	..	398¼	,,	274	13	3	

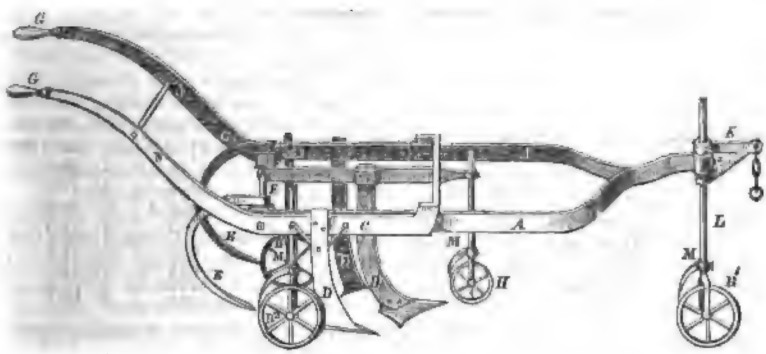
GENERAL RESULT.

In the year 1838	....	12604	tons coke consumed,
1839	....	11754	,, ,,
1840	....	6518	,, ,,
1841	....	4508	,, ,,
1842	....	3393	,, ,,
1843	....	3103	,, ,,

VI. *Reports by Sir John Macneil on the Eligibility of the Atmospheric Principle as a Moving Power on a Line of Railway; and on the Selection of the Banks of the Grand Canal as the Ground for a great Trunk Line.*

BRUCE'S IMPROVED SKIM, OR STUBBLE PLOUGH.

[Registered under the Act for the Protection of Articles of Utility. John Bruce, of Tiddington, near Stratford-on-Avon, Agricultural Implement Maker, Proprietor.]



The plough represented in the above engraving was honoured with a prize at the recent exhibition of the Royal Agricultural Society at Southampton. The principal purpose to which it is intended to be applied is the paring or cutting down of stubble, and it is so constructed as to work equally on level and uneven ground.

A A is the framework of the carriage, which is supported on the front guide-wheel B^1, and the two hind wheels B^2 B^2. C C is a second framework, distinct from the other, to which the skimmers D D D, and curved hind coulters E E, are attached; it is connected to the other framework, A A, by a cross bar F, on which the whole of the framework, C C, turns freely, as on a centre, when acted on by the handles, G G, of the arms, or, as they are commonly called, tails, N N, which project from the back end of the framework C C, and are made in one piece with it; H is a small wheel in front of C C, on which it rests when the machine is set to work, and by which it is made to accommodate itself to the varying inclinations of the ground, so as to work equally well over ridge and furrow. The skimmers, D D D, are for paring the stubble, and the curved coulters behind, E E, are for stirring up the parings so as to leave them in a better state for harrowing and clearing. The

framework, A A, is connected at its outer extremity to the yoke K by a vertical spindle L, which springs from the guide-wheel B^1, and passes upwards through corresponding holes in the framework and yoke. The vertical spindle L turns freely in its bearings, so as to allow of the wheel B^1 turning round in any direction. When it is desired to ease the machine, as at the end of the furrows, for the sake of turning round more readily, the handles, G G, are pressed down, which raises the whole of the framework C C, with the skimmers and coulters and wheel attached to it, and by throwing up or loosening the tails, as it is called, the machine is restored to the same working state as before. To adapt the machine to the depth to which the surface is required to be pared or cut, the wheels, B^1 and B^2, can be fixed higher up or lower down by means of the screw pins X X. M M M M are scrapers, fixed in such position in regard to the wheels as to free them from any adhering earth or dirt. The whole of the instrument is of iron, with the exception of the handles, G G, which are of wood.

THE PATENT ARGAND FURNACE.

Sir,—Your correspondent "Ignis" appears to be one of that *ignis fatuus* tribe, that would rather mislead than enlighten. His object being to disprove that Mr. Williams is the inventor of the peculiar "*method* of dividing the stream of air caused to mingle with the inflammable gases in his furnace, by passing it through a number of *small* apertures," he should have described the *method;* and stated what is meant by *small* apertures. But the above is all the description he considers that plan merits, while from the *Annales des Mines* for 1836, he quotes very minutely the construction of M. Virlet's furnace for carbonizing wood at the mouth of iron furnaces. In common fairness, he ought to have quoted parallel passages (if to be found) from Mr. Williams' *Treatise on Combustion;* or, as an impartial critic, he might at least have referred to the pages of that work, wherein the general reader might satisfy himself whether the bold statements advanced were correct. But no; "Ignis" seems to have had a personal object in view, of a very doubtful character; and, under the semblance of great critical acumen and philosophical research, he lauds the French civil engineer, merely to depreciate the merit justly due to Mr. Williams.

After giving the quotation in question, "Ignis" says, "Here the principle of *dividing* the streams of *mixing* air and gases is clearly recognized." Now, I defy "Ignis," to point out the recognition of this principle in any of Mr. Williams's writings.

The quotation does not allude to a plan for smoke prevention, by burning the impure coal gas in the furnace, but to a method of burning the carbonic oxide gas, thereby to heat a wood-carbonizing apparatus, "at the mouth of iron furnaces." M. Virlet talks of a *certain* quantity of air being needful; of apertures one or two inches in diameter; and of a rapid draught *not* being required. If, however, we turn to Mr. Williams's Treatise, we there find the *certain* quantity of air scientifically defined. Mr. Williams nowhere recommends large holes of one or two inches in diameter; and for the full operation of his air-diffusion apparatus, a good draught is requisite, because he is dealing with the smoke-making coal gas, which requires double the quantity of air, compared with the smokeless carbonic oxide consumed by M. Virlet's process.

"To Mr. Williams," says "Ignis," "belongs the *merit* of having more fully insisted upon the *known* principles of burning coal, as perfectly as possible, than had been before done." Indeed! but what *merit* is there in that? "Ignis" assures us that the labours of Watt, Count Rumford, Tredgold, and Virlet, deprive him of "ground for *any* pretension to originality in his arrangements for combustion." Having thus dismantled, disfigured, and defamed one whom he most undoubtedly loves with a perfect hatred, he arrives at this electrifying climax;—"After all, perfect combustion of coal in furnaces is a HUMBUG." It is difficult to understand what "Ignis" would be at. His lament commencing, "Alas, poor Tredgold!" cannot but be appreciated, coming from such an unbiassed source!

The last and most unreasonable charge brought against Mr. Williams, is, that his Treatise "would have been clearer

if not obscured by a needless parade of chemistry." Now the very title of that work indicates its object, "*The combustion of coal and the prevention of smoke, chemically and practically considered;*" and we find the *chemistry* of combustion, as therein treated, rendered so clear, that, except to a person of very dull apprehension, there cannot appear anything like a "needless parade of chemistry." Indeed, it would seem to be a chief excellence of Mr. Williams's Treatise, that he has brought this difficult subject home to the plainest comprehension, so that the practical mechanic may read and learn important scientific facts in a new, plain, and simple dress.

I am, your obedient servant,

HENRY DIRCKS.

77, King William-street, City.
July 30, 1844.

STUBS' WINDOW BLIND AND ROLLER MAP TACKLE.

[Registered under the Act for the Protection of Articles of Utility. George Stubs, of Warrington, Lancaster, Proprietor.]

Window blinds, or rather maps, fitted with this improved tackle, are intended to descend by means of their own weight, and to be raised by means of the tackle to any degree required.

Fig. 1 represents the application of the tackle to a window blind. The cord or pull, A, consists of three distinct parts of about equal lengths, *a b c*. The upper part *a*, which winds immediately round the roller B, is of hempen cord or gut; the second, *b*, is of silk, and connected to the former by a ring *d*; the third, or lowest part, *c*, consists of a small chain. The roller B is supported as usual in brackets *x x*. The cord works round the pulley in the direction opposite to that of the cloth on the roller. C D are two wire staples, which are let into the window casing, and encircle the cord, so that the upper one, C, forms a stop to the ring *d*, when the blind is let down, and the lower one, D, forms a stop to the ring when it is raised. The blind can be kept at any required height by passing one of the links of the chain part *c* on to the pin E.

In the side view of the bracket, given in fig. 2, a small pulley, *p*, is represented as introduced; the only object of this is to bring the cord close to the

Fig. 1.

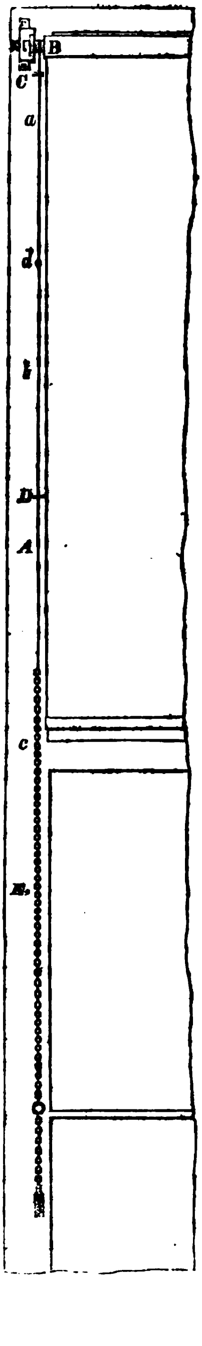
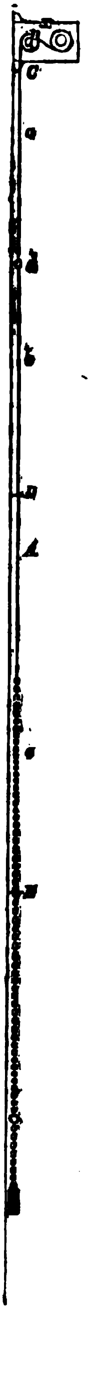


Fig. 2.



face of the architrave. When the bracket is fastened to the inside of the window casing this pulley is not needed, but in such cases a guide is necessary to prevent the cord being drawn off the pulley.

WHEEL-WORK—INVESTIGATION OF SOME PRACTICAL RULES FOR CALCULATING THE SPEEDS, ETC., CONNECTED WITH THE INTERNAL TOOTHED WHEEL.

The internal wheel is generally made to run loose upon some shaft; on this shaft is fixed an intermediate stud wheel, or perhaps, more properly, a planet wheel, which gears into the internal wheel, and which also gears into a pinion or sun wheel that runs loose on the shaft.

In order to investigate a formula expressing the general relation amongst the above wheels, let s denote the speed of the shaft, s^1 the speed of the internal wheel, s^2 the speed of the pinion, t^1 the number of teeth in the internal wheel, and t^2 the number of teeth in the pinion. Then, supposing the pinion not to move, it is evident that, for each revolution of the shaft, the internal wheel will make one revolution, together with the quantity $\frac{t^2}{t^1}$, which is communicated to the internal wheel by the planet wheel, the latter receiving it from the sun wheel as it revolves round it. Consequently, in s revolutions of the shaft, the internal wheel will make, on this supposition, $s\left(\frac{t^2}{t^1}+1\right)$ revolutions. But the pinion making s^2 revolutions in the same time, we shall have to increase or diminish the above number by the quantity $\frac{t^2}{t^1}s^2$, according as the pinion revolves in the contrary or in the same direction of the shaft. Hence we shall have, generally,

$$s^1 = \frac{t^2}{t^1}(s \pm s^2) + s.$$

From this equation we deduce the following rules, which will, perhaps, be of use to the practical mechanic.

I. Given the speeds of the shaft and pinion, and also the respective number of teeth contained in the pinion and the internal wheel, to find the speed of the latter.

Note. The shaft and pinion are here supposed to revolve in the same direction; but if the pinion revolve in the contrary direction of the shaft, the following rules will apply by taking the word included in the parenthesis for that immediately following, everything else being the same.

Rule. Multiply the (sum) difference of the speeds of the shaft and pinion by the number of teeth in the latter, and divide the product by the number of teeth in the internal wheel; to the quotient thus found, add the speed of the shaft, and the sum will be the number of revolutions made by the internal wheel.

Example. Suppose the shaft to make 210 revolutions per minute, and the pinion 40; the number of teeth in the internal wheel = 70, and the number in the pinion = 14. Then,

$$14 \times \overline{210 - 40} \div 70 + 210 = 14 \times 170 \div 70 + 210 = 34 + 210 = 244,$$

the answer.

II. Given the speeds of the internal wheel and pinion, and also the number of teeth in each, to find the speed of the shaft.

Rule. Multiply the speeds of the internal wheel and pinion by their respective number of teeth, and divide the (difference) sum of the products by the sum of the number of teeth in the internal wheel and pinion for the answer.

Example. Suppose the internal wheel to make 244 revolutions per minute, the other numbers being as before. Then,

$$70 \times 244 + 14 \times 40 = 17080 + 560 = 17640, \text{ and } 70 + 14 = 84;$$

therefore $17640 \div 84 = 210$, the speed required.

III. Given the speeds of the internal wheel and shaft, and also the respective number of teeth contained in the internal wheel and pinion, to find the speed of the latter.

Rule. Multiply the difference of the speeds of the internal wheel and shaft by the number of teeth in the internal wheel, and divide the product by the number of teeth in the pinion; then deduct this number from the speed of the shaft for the answer. But if the pinion revolve in the contrary direction of the shaft, the above number must be diminished by the speed of the shaft.

Example. Retaining the above numbers, we shall have

$$210 - 70 \times \overline{244 - 210} \div 14 = 210 - 70 \times 34 \div 14 = 210 - 170 = 40,$$

the speed required.

IV. Given the three speeds and the number of teeth in the pinion, to find the number of teeth in the internal wheel.

Rule. Divide the (sum) difference of the speeds of the shaft and pinion by the difference of the speeds of the internal wheel and shaft, and multiply the result by the number of teeth in the pinion for the answer.

Example. Using the above numbers, we shall have $210 - 40 = 170$, and $244 - 210 = 34$; therefore,

$$14 \times 170 \div 34 = 70.$$

V. Given the three speeds and the number of teeth in the internal wheel, to find the number of teeth in the pinion.

Rule. Divide the difference of the speeds of the internal wheel and shaft by the (sum) difference of the speeds of the shaft and pinion, and multiply the result by the number of teeth in the internal wheel for the answer.

Example. Here $244 - 210 = 34$, and $210 - 40 = 170$; therefore,

$$70 \times 34 \div 170 = 14,$$

the number of teeth required.

SEPTIMUS TEBAY.

Preston, July 27, 1844.

CAPTAIN WARNER'S SECRET DESTROYER, NO SECRET.

When we stated last week that it appeared from the accounts given in the newspapers, and more particularly from the certificate of the three naval captains, Ingestre, Dickenson, and Henderson, that Captain Warner was in "truth in possession of the secret of an instrument of destruction immeasurably exceeding in power everything hitherto known," we but yielded, like others, to the force of the evidence then before us. We thought it infinitely more improbable that so many eminent and credible witnesses should be deceived with their own eyes, than that Captain Warner should have actually hit upon so remarkable a discovery. It now turns out, however, that the whole "cloud of witnesses" were as grossly deluded—miserably humbugged—as if they had been all, miles high in the air, with thick—very thick—banks of fog and vapour, between them and the scene of the explosion.

In a discussion which took place in the House of Commons on Wednesday night last, Sir George Cockburn, one of the Lords of the Admiralty, said "he would state *exactly how the experiment had taken place.* He had an officer in a boat close to the two vessels, and the officer distinctly saw the one blown up. *A rope with two buoys attached was thrown across her cutwater, the vessel then going at the rate of about three knots an hour; these two buoys, by the impetus of the vessel, were forced under water, and the tension of the rope attached to them either struck a hammer, or excited by other means the igniting power, and then the vessel blew up.* The officer who had reported to him said, he considered that the explosion was the effect of two barrels of gunpowder." So there the mystery ends. By such means nothing easier.

Sir CHARLES NAPIER informed the House that exactly the same thing had been done forty years ago, only that it was done openly, and nobody deceived by it. He read the following account of the experiment to which he referred from some public journal of the period. "An experiment of a newly invented machine for destroying ships at anchor was tried in the Downs, and succeeded in the most complete manner. A large brig was anchored abreast of Walmer Castle, about three quarters of a mile from the shore. Two or three galleys then rowed off, and *placed the machine across the cable of the brig, which by the running of the tide, was soon forced under the bottom, about the centre of the keel, where it attached itself.* In a few minutes the clockwork of the machinery having performed its operation, a small cloud of smoke was seen to rise from the vessel, which in a moment after was blown to atoms, without any noise or appearance of fire. In about

27 or 28 seconds not a vestige of the brig was to be seen, as the fragments were then level with the water's edge."

Sir GEORGE COCKBURN added that the long rangė (Captain Warner had spoken of seven miles!) was the only discovery, which, *if proved*, would be valuable. But range, in this instance, there was none; the instruments of explosion, however composed, were floated by the tide to the object of attack. In fact, they were not projectiles at all; but things by which ships are to be blown up in the same way that birds are sometimes directed to be caught—by sprinkling salt on their tails.

FULTON'S PLAN OF BLOWING UP SHIPS FROM UNDER WATER.

In the *Annual Register* for 1802, is an account of Mr. Fulton's diving-boat, taken from the relation of Citizen St. Aubin, a man of letters at Paris, and a member of the Tribunate, which confirms the inventor's own statement of the success of his experiment. "I have," says Monsieur St. Aubin, "just been to inspect the plan and section of a nautilus, or diving-boat, invented by Mr. Fulton, similar to that with which he lately made his curious and interesting experiment at Havre and Brest. The diving-boat, in the construction of which he is now employed, will be capacious enough to contain eight men, and provision enough for twenty days, and will be of sufficient strength and power to enable him to plunge one hundred feet under water if necessary. He has constructed a reservoir for air, which will enable eight men to remain under water for eight hours. When the boat is above water, it has two sails, and looks just like a common boat. When she is to dive, the mast and sails are struck. In making his experiment at Havre, Mr. Fulton not only remained a whole hour under water, with three of his companions, but kept his boat parallel to the horizon at any given depth. He proved that the compass points as correctly under water as on the surface; and that, while under water, the boat made way at the rate of half a league an hour, by means constructed for that purpose."—Vol. xliv.

Whatever might be the ingenuity of the contrivance, or merit when effected, of the *bateau plongeur*, it is certain that Earl Stanhope, no incompetent judge of mechanical and scientific subjects, entertained a formidable idea of its efficiency, and earnestly endeavoured to impress upon the English government a sense of the danger that might arise to this country, in consequence of the French nation having taken the American, Mr. Fulton, under their protection. In the following year (1803) his lordship again referred to Mr. Fulton's contrivance for blowing up ships under water, and stated in the House of Lords that he had himself given a plan to the Admiralty for preventing the effect of an invention which he considered of so formidable a nature.

It is evident that the art of navigating under water might convey an awful power into the hands of any one who possessed it; and consequently the British ministry did not think it unworthy of inquiry how far Mr. Fulton's pretensions to success, in so formidable an art, were well founded or not. Mr. Cartwright, who was probably in full possession of Mr. Fulton's secret, and no less impressed than Earl Stanhope with the notion of its dangerous extent, was consulted in this inquiry. On the renewal of the war, Mr. Fulton's neutrality, at least, was considered worth the purchase, and Mr. Cartwright was appointed one of the arbitrators to settle the terms upon which Mr. Fulton consented to the suppression of his secret. The terms of the award were probably satisfactory to Mr. Fulton. He returned to America not long after the arrangement alluded to, and in the following summer (1807) he had the satisfaction of seeing accomplished his long-cherished and favourite project of launching a steam-boat in his native country.—*Memoir of Dr. Cartwright*, 1843.

EXPECTATION OF LIFE.

Sir,—I beg the favour of your inserting the following question in your excellent Magazine.

What was the expectation of life, on the following classes of lives, in the years 1800 and 1840? Such lives are here referred to as are accepted at Insurance offices, and which compose the body of life annuitants.

Age.	Males.	Females.
20		
30		
40		
50		
60		

The object is to ascertain how much the value of insurable lives, and the lives of life annuitants, has improved in about the last forty years. Your constant reader, A. B.

July 24, 1844.

HUTCHINGS' REGISTERED IMPROVEMENTS IN BOOT AND SHOE SOLES.

Sir,—Being a constant reader of your valuable publication, I am brought acquainted with the various inventions and improvements that are continually taking place in

our numerous manufactures. Some months since I observed in one of your Magazines a description of an improved method of preparing and applying soles to boots and shoes, invented by Mr. John Hutchings, of Bath. I was very much struck with its simplicity and usefulness, the more so perhaps, from having myself been in business upwards of thirty years in the boot and shoe trade.

Happening to be staying in Bath for a short time in the early part of last winter, I availed myself of the opportunity of purchasing boots on Mr. Hutchings's system, at his shop, and now I intend never to wear any other, for I have invariably found them what the inventor describes them to be, most comfortable, durable, and economical In my humble judgment they afford the surest protection against colds and rheumatism, as no dampness can penetrate through the soles. Hoping the public, as well as the inventor, may be benefited by this useful improvement, I remain, Mr. Editor,

Your most obedient servant,

E. B. JACKSON.

Laburnum Cottage, Regent's Park.

WIRE ROPES.

The efficiency of wire ropes, as compared with hempen, became, in rather a curious way, the subject of legal enquiry the other day, on the Northern Circuit. A person of the name of Backhouse, employed in the Wingate Colliery, brought an action against the proprietors to recover a sum of money which he alleged to be due to him under the terms of his pit bond. The defendants pleaded that he had been refused his wages because he had refused to work; to which the plaintiff replied that his refusal arose from the defendants' neglecting to supply, provide, and maintain *sufficient* means of descent and ascent, inasmuch as they had substituted for the old hempen ropes in use the newly invented wire ropes, which were unsafe, dangerous, &c. The real question, therefore, which came to be tried was, whether the wire ropes were as secure as the others? The jury decided in the *affirmative*. We quote the following abstract of the proceedings from the *Times*:—

For the plaintiff a great deal of evidence was adduced to show the insecurity of the wire rope. It appeared that the use of wire ropes in collieries dated only since the end of the year 1842, when they were introduced in various parts, both in working inclines, and raising coals from the pit. Those used on the inclines were chiefly round, while those at the collieries were made flat for the greater facility of rolling them on the drum. In the latter end of the year 1842 a rope of this kind began to be used at the Wingate Colliery. It was in use for about six months, when it met with an accidental injury from the engineman carelessly allowing the cage with the coal to be drawn up too far, and thus to come in contact with the woodwork over the mouth of the pit. The effect was to stop the engine, but the rope did not give way. It was, however, taken off to be examined, and replaced by a hempen one. In April, 1843, the wire rope, consisting of 96 wires, was again put up, and was worked in conjunction with another rope of 144 wires. This latter rope met in June with an accident in consequence of the cage coming in contact with the mouth of the pit, and on examination it was found that one whole strand of six wires was broken, and that other single wires had given way. It was, however, worked until the evening, when it was taken off for examination, and a hempen one fitted up in its stead. Complaints of the other rope were the next day made by the men. It was alleged that single wires were broken in several places, and that as many as five had given way in one spot. This was alleged as a reason for their not descending to their work. Mr. Armstrong, the manager, expostulated with them on the subject, and endeavoured to show them, that though some of the wires were broken, there was nothing that could at all affect its security. Offers were made on one side and the other to refer the question to some competent authority, but they finally could not agree on a choice of the person or persons who should inquire into the matter; and, on the 10th of June, the parties made their appearance before the magistrate. It was there proposed by Mr. Armstrong that the rope should be tested by a machine, if the men would pay the expense; and he finally offered to test it with a weight of 20 tons as it hung in the shaft. It was finally put to the test, with a weight, however, of 10 tons only, the pulley over which it was carried at the top not being, as was alleged, capable of carrying more. The result of this experiment was not satisfactory to the miners present. They alleged that the rope yielded somewhat with the weight, and that the strands at the upper part opened. The rope was examined throughout its whole length by a Mr. Chicken on their behalf, and it appeared that 19 wires were broken at different parts of its whole length. Of these five were broken at one spot, and four at another. A piece of the rope was cut off and handed over to them as the subject of any experiment they might choose to make.

A Mr. Galloway, who had been for many years engaged in the manufacture of iron, stated, that he examined the rope in question, which was on the scale of 1 cwt. to four fathoms. He was of opinion that the strength of the rope was diminished in proportion to the aggregate amount of wires fractured. He thought the rope might bear a strain of 27 tons when new, but it would be very injurious to it to expose it to a strain at all approaching to that amount, as its elasticity would thereby be permanently injured. The breaking of a single wire shows that all are strained, and that the elasticity of the whole rope is impaired. He thought the rope in question might carry 3½ tons, the usual weight upon it, but would not be safe with that weight in case it met with a jerk.

Other evidence was adduced as to the manner in which the rope stood the test of the 10 tons. It was shown that nine ropes had given way in the Coxhoe and Jarrow collieries. In the former case, however, the rope was flat, and consisted of undivided skeins of wire, laid alongside of each other; in the latter, the rope had been lying idle for six weeks in consequence of the turn out.

For the defence evidence was adduced to show that a portion of the rope was submitted to a strain of upwards of 19 tons before it gave way; that a single strand of six wires was able to carry upwards of 19 cwt., and a single wire 3 cwt.; that with the test of the 10 tons in the shaft it was perfectly elastic, and that the weight rose and fell some inches, and that on examination afterwards it showed no symptoms of any strain. It was further stated, as the opinion of the scientific witnesses, that the diminution of the strength of the rope would not be in proportion to the whole number of fractures, but to the num-

ber at one spot. The cohesion of the wires from the twisting of the rope is such, that a wire at the extremity of the rope, fractured 5 inches from that extremity, will not pull out from the rest, but break if a sufficient weight is applied. So much is this the case that a single strand of the rope in question, consisting of six wires, had individual wires divided at different places throughout its whole length, so that every wire of the six was divided within the space of every foot, and yet even in that state it bore a strain of 12 cwt. 3 lbs. before it gave way. The weight usually carried by the rope at Wingate Colliery was three tons and a half.

Evidence was also adduced of the fact of wire ropes being used at various collieries throughout the country, and that they were generally looked upon as much safer than hemp; that they were better, and that any symptom of weakness was sooner perceived.

The Jury, after being for some time out of the box, returned a verdict for the defendants.

NOTES AND NOTICES.

Death of Dr. Dalton.—We regret to learn the sudden death of that celebrated chemist and philosopher, the venerable Dr. Dalton, of Manchester, whose decease took place rather unexpectedly, but apparently without pain, at an early hour on Saturday morning last, in the 78th year of his age. His death is presumed to have been occasioned by paralysis, of which he had suffered three attacks since April, 1837. In him science has lost one of the greatest philosophers of his age, and humanity one of its brightest living examples. Dr. Dalton had been for more than half a century an active and invaluable member of the Literary and Philosophical Society of Manchester, having, together with his friend Dr. Edward Holme, M.D., F.L.S., been elected on the 25th of April, 1794. Indeed they were the oldest surviving members of the society, with the sole exception of Sir George Philips, Bart., who became a member in 1785. Dr. Dalton had been president of this society since 1817. He was born at Eaglesfield, near Cockermouth, in Cumberland, on the 5th of September, 1766, of respectable parents, and gave early indications of mathematical ability. In 1781, he became a mathematical teacher in Kendal, from whence he contributed largely upon mathematical, philosophical, and general subjects, to the "Gentleman's" and "Lady's Diary." In 1788, he commenced his meteorological observations, which he continued throughout his life. In 1793, he was appointed Professor of Mathematics and Natural Philosophy in the New College, Mosley-street, Manchester, and continued to hold his office until the college was finally removed to York. He was elected Fellow of the Royal Society in 1821 or 1822, and was also a member of the Royal Society of Edinburgh and of several foreign academies. In 1826, he was presented with a gold medal by the Royal Society as the individual most eminent for his scientific discoveries. In 1833, a sum of 2,000*l.* was raised for the erection of a statue to perpetuate his remembrance, and the task was entrusted to Sir Francis Chantrey, who brought to the execution of his subject a warm admiration of the man, and a proportionate desire to do him justice. The statue when completed was deposited in the entrance hall of the Royal Manchester Institution.

Artesian Well at Southampton.—In 1837 the important subject of the supply of water was brought more particularly under the attention of the inhabitants of this town, and at the desire of some of the more spirited and scientific residents an experimental boring was made upon the common, at a distance of about two miles from the town, and at an elevated spot north of its site. This experiment indubitably proved that an unfailing supply of water could be procured in such unlimited quantity as, it was hoped, to be supplied to the inhabitants at a reasonable cost. In consequence, measures were immediately taken to sink a shaft. The works have now been in progress some years, and, as will be seen, the artesian well of Southampton is, though uncompleted, a work of the greatest magnitude, vying with, if it does not surpass, the great well of Grenelle, by which Paris has lately been supplied. The depth of the Southampton well is at present 1,300 feet. The shaft descends through 78 feet of alluvium, 300 feet of clay similar to the London clay (which is a general substratum in the Southampton basin), and through another 100 feet of plastic clay, before it reaches the chalk, through which it descends 100 feet still further. Thus from the surface a well has absolutely been built downwards nearly 570 feet, and under such difficulties from irregularities in the strata that four iron cylinders have been placed in points where no attempt at masonry could have proved successful. Not the least singular part of this work is the manner in which this underground well has been built from the summit level downwards "into the very bowels of the land." This is a matter, however, which it would be tedious to describe; suffice it, therefore, to say, that after reaching nearly 600 feet, the operations of the masons were suspended, and the boring-rods were brought into operation, and employed until, through their instrumentality, the contractors have reached a depth of 1,300 feet. As might be expected, the supply of water is already abundant. It now rises to within 40 feet of the surface, and by the aid of powerful steam-engines no less than 55,000 gallons a-day are literally poured into the town of Southampton.—*Correspondent of the Times.*

Lord's Brougham's new Bill affecting the Law of Patents.—A bill amending former acts relating to the privy council, and to the extension of its jurisdiction and powers, has just been brought into the House of Commons, from the House of Lords, some of the clauses of which relate to the extension of patent terms in certain cases. Clause second declares it expedient to extend the term of patent, in cases in which it can be satisfactorily shown that the expense of the invention has been greater than the time now limited by law will suffice to reimburse; and enacts that, if any person before the expiration of his patent term, shall present a petition to her Majesty, setting forth that an exclusive right of use and sale for the further period of *seven* years, in addition to his patent term, will not suffice for his reimbursement and remuneration, and if such petition be referred by her Majesty to the judicial committee of the privy council, and that committee shall report to her Majesty that *a period greater than seven years'* extension, ought to be granted to the petitioner, the Queen may grant an extension thereof for any time not exceeding *fourteen* years, subject to the rules of the act of the 6th Vict. The third clause authorises the committee to report, and her Majesty to grant, extension for a lesser term than that prayed. Clause four authorises her Majesty, on the report of the committee, to grant extension under either act, *either to assignees, or to the original patentees, or to assignees and patentees conjointly.* The fifth and sixth clauses give power to make disclaimer and memorandum of alteration, notwithstanding the original patentee may have assigned his patent right; and where such has already been made, to declare it valid. The seventh clause declares to be valid all new letters patent, granted under 6th William IV., to assignees before the passing of this act.

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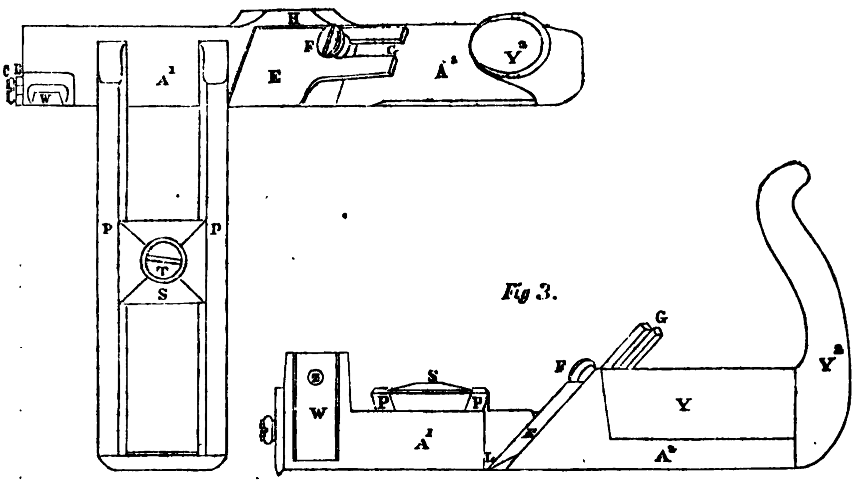
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1096.] SATURDAY, AUGUST 10, 1844. [Price 3d.

Edited by J. C. Robertson, No. 166, Fleet-street.

SILCOCK AND LOWE'S PATENT PLANES.

Fig. 1.



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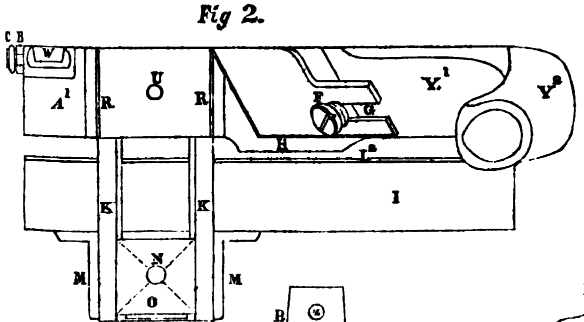

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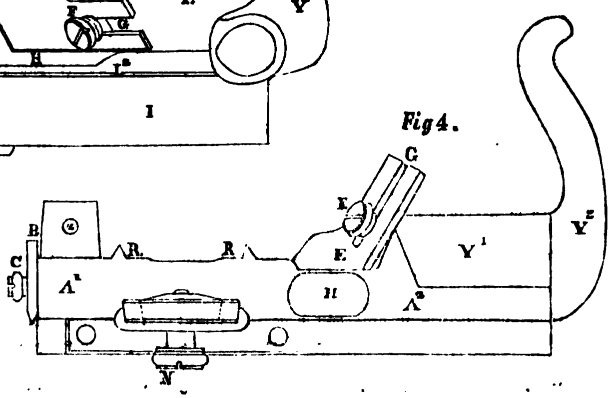

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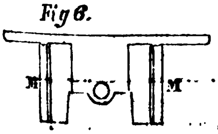


SILCOCK AND LOWE'S PATENT PLANES.

[Patentees, Messrs. Silcock and Lowe, Birmingham. Patent dated, January 31; Specification enrolled, July 31, 1844.]

The best judges of the value of tools, like those which form the subject of this patent, must necessarily be those who are in the daily practice of using them. That they have been approved by the Board of Admiralty, or Board of Works, is in our estimation but a small affair compared with their having passed through the ordeal of such a body of practical men, as the cabinet-makers of Birmingham, who, at their last monthly meeting, came unanimously to the following resolution:—

"That this Society do fully approve of Messrs. Silcock and Lowe's Planes, as *a great improvement and advantage, and recommend them to the trade as very useful and cheap articles.*

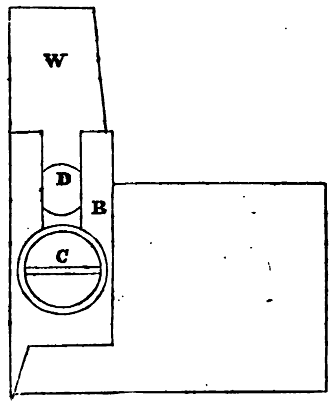
(Signed)

"Jno. Sharpe, President.
John Shelly, Vice-President.
James Millington, Secretary."

The *first* of these planes is certainly a very remarkable instrument. It is a double fillister plane, which is so constructed that it is capable of filleting boards *of all sizes from about ⅜ths of an inch to about* 3 *inches*, and may be adapted to the several purposes of *a filliting plane, a side fillister, a sash or back fillister, and a skewed rabbet plane.*

"Figure 1 is a top view of the right side plane of this double fillister; and figure 2 a similar view of the left side plane; figure 3 is a side elevation of figure 1; and figure 4 a side elevation of figure 2. These two planes, when joined together by the chase or frame P, in manner afterwards explained, form the entire tool in its most complete state. A^1 A^1 are the fore-parts of the body of each plane, and A^2 A^2 the back parts, H H are the pieces which connect the front and back parts, Y^1 Y^1 are the stocks, and Y^2 Y^2 the handles. B B are the vertical cutters attached to the fore-ends of the planes. A front view of one of these cutters is given in figure 5. It is fixed in its place partly by means of a screw C, passed through a cleft in the upper end of the cutter, into the fore-end of the body of the plane, and partly by a pin D, which projects from the fore-end, and fits into the cleft; the addition of the pin D being requisite to keep the cutter perpendicular to the side of the plane, and also to prevent it from being

Fig. 5.



driven aside when in the course of use. E E are the horizontal cutters, or what are ordinarily called 'the irons,' which instead of being fixed as usual by means of wedges, are secured to their beds by screws F F, passed through clefts, G G, in the top-ends of the irons, into the stock. L is the mouth of the plane; P is a chase or frame which projects from, and is attached at the inner end to the top of the fore-part, A^1, of the body of the right hand plane, and slides into a recess, R R, on the top of the fore-part, A^1, of the body of the left hand plane, the outer edges of the chase P being bevelled inwards, and the inner edges of the recess R bevelled outwards, to correspond with the former. According to the length to which this chase P is slid into the recess R, will necessarily be the distance preserved between the two planes, and that distance may be varied to suit (as before-mentioned) boards of all sizes from three-eighths of an inch to three inches.

"To fix the planes at any required distance from each other, there is a traversing male screw T, attached to the chase P, which takes into a female screw U in the recess R, this screw T having a sliding cushion S, by which it can be moved to and fro to any part of the frame P, and the sides of the cushion S being bevelled, to correspond with the bevelled inner edges of the chase P. I is a fence, by which the distance between the check or fillet, and the front of the deal, is regulated. L^2 is the inner edge plate of the fence. K is a chase or frame (similar to P) which projects from and is attached at the inner end to the bottom of the fore-part of the left hand plane, and M (a separate

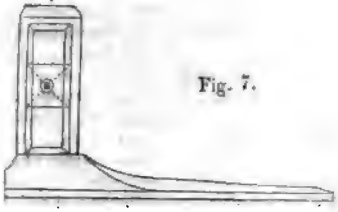


Fig. 7.

Fig. 8.

Fig. 9.

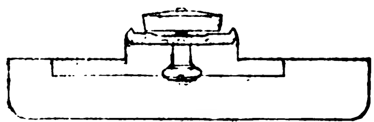
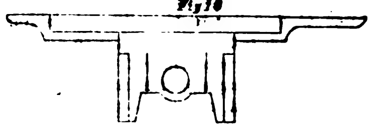
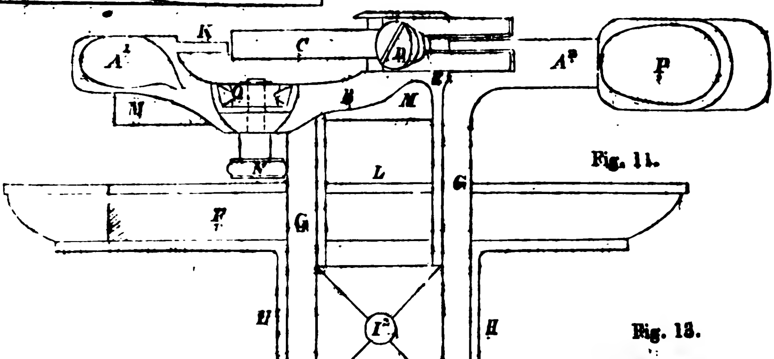


Fig. 10.





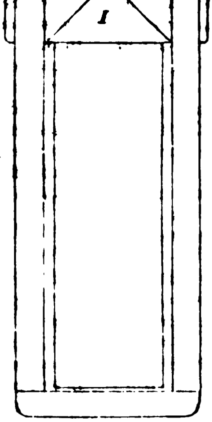


Fig. 11.

Fig. 13.

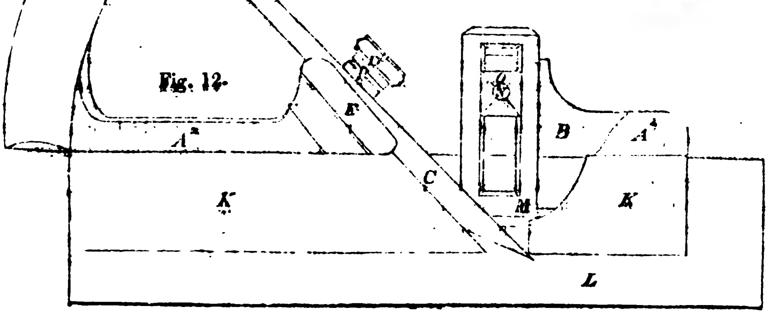


Fig. 12.

view of which is given in figure 6) is a third chase, which projects from, and is attached to, the outer edge of the fence I. The chase M, sliding within the chase K, and the two chases having for this purpose corresponding bevels at the parts where they come in contact, the lower chase M carries a fixed screw N, and the upper one a sliding nut O, (similar to the sliding cushion S,) so that when the fence has been adjusted to any required position, it can be secured there by bringing the nut O over the screw N, and screwing up the one into the other.

"To regulate the height to be given to the fillet, a stop, of which side and top views are given separately in figures 7 and 8, is made use of. The stem V of this stop fits into a recess W in the fore-end of the body of the plane, and by passing a screw X through a slot in the stem V and the hole Z, the stop is fixed at any required degree of elevation, and the depth of the cut thus determined.

"When this tool is to be used as a filleting plane, both the right and left side planes are employed, combined together in the manner before represented, and fixed at a distance from each other, corresponding to the breadth of the fillet. To use it as a side fillister, the left side plane only (represented in figures 2 and 4) is required, with the stop inserted into the recess W. When it is to be used as a sash or back fillister the right side plane only (represented in figures 1 and 3) is employed, but with a slight modification in the figure of the fence, which is made as represented in the side and top views, figures 9 and 10.

"To use the tool as a skewed rabbet plane, the right hand plane with its chase P and the fence F are laid aside, and the left hand plane only employed.

"All the parts are of cast-iron, protected by tinning or zinking from corrosion, with the exception of the stock, the handle and body of the fence, which are of wood, and with the exception also of the screws F F, the cushion of the travelling screw T, and the sliding nut O, which are all of brass.

"The fore and back parts, A^1 and A^2, are cast in one piece. The wood of the handle is not cut across the grain as usual, but with the fibres running in a direction at right angles with the body of the planes, whereby a considerable increase of strength is gained."

The *second* instrument described is a fluting or grooving plough, constructed in the manner represented in figures 11 and 12.

"Figure 11 is a top plan, and figure 12 a side elevation of this tool. A^1 is the fore-part of the body, and A^2 the back part, which are connected together by a bow-shaped piece B. C is the cutting iron, shown separately in figure 13, which is secured to its bed by a screw D, in the same manner as the irons of the double fillister plane before described, and made still more secure by the addition to the bed of two side pieces, or cheeks, E E, within which the cleft or upper end of the iron is made to fit tightly. In the back of this iron, as in ordinary plough irons, there is a V groove, for holding this iron to the plough plate K. The cleft in the upper end of the iron is bevelled towards the back, and the brass washer R, through which the screw D is passed, is made with a corresponding bevel, by which arrangement the iron is prevented from being drawn out of its place, on the back stroke of the plane, from any accumulation of chips in the groove. F is the fence with its edge plate L. It is fixed at any distance required from the cutting iron by means of two chases G and H, and a traversing nut and screw I^1 I^2, all similar to those employed in the case of the double fillister plane before described. M is the stop by which the depth to be given to the groove is determined; it is fixed and shifted by means of the screw N, which is passed through a nut O into a hole in the bow-shaped connecting piece B. P is the handle.

"In this tool the body is wholly of metal, but in all other respects, as regards the materials and mode of putting them together, it possesses the same peculiarities as the double fillister plane first described."

The *third* instrument is a dado grooving plane, with which *no less than sixteen and more different sizes of work may be executed.*

"Figure 14 is an elevation, and fig. 15 a plan of this tool. A A^2 are the front and back parts of the body of the plane, which are connected together by the bow-piece B; D is a plate (cast in the same piece with the body,) the lower edge of which forms the sole, and is about the eighth of an inch thick; E is the plane iron, which is made at the upper end, and secured in its seat, both in the same way as the irons of the double fillister and grooving planes before described, and terminates at the cutting end in two projecting edges, *a a*, which, when the iron is ground, and set up, act as side cutters. A view of a three-quarter inch iron, adapted to this plane, is shown separately in figure 16, but the size may vary from an eighth of an inch to an inch and a quarter; F is a stop fence for regulating the depth of the groove; it is fixed

Fig. 14.

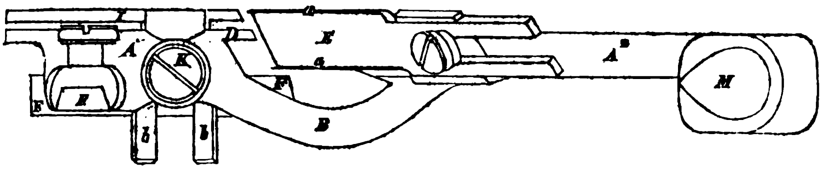


Fig. 16.

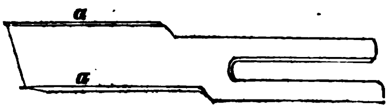


Fig. 15.

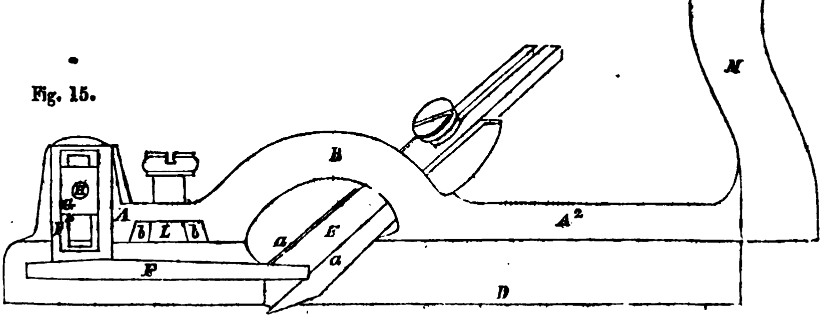


Fig. 18.

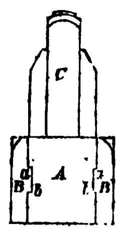


Fig. 17.

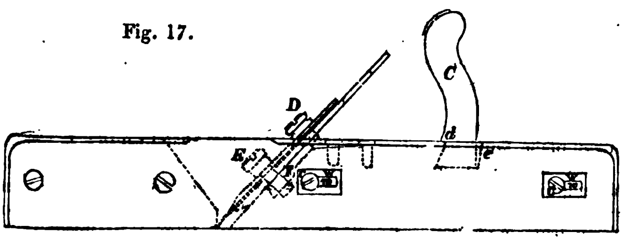


Fig. 19.

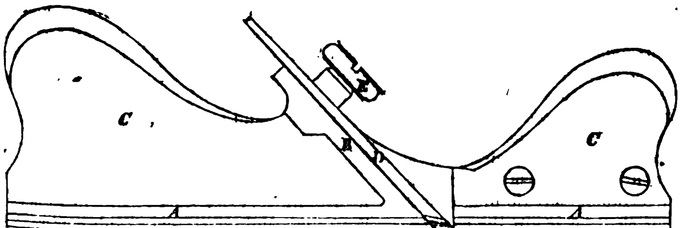


Fig. 20.

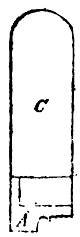
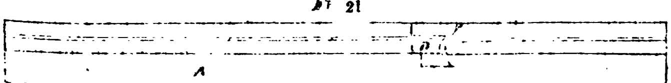


Fig. 21



and shifted by means of an upright-arm, F^2, which slides in a groove in a projecting part of the fore-body of the plane, and a traversing nut and screw, G H. I is a side fence, the under edge of which is all but flush with the sole of the plane; it has two bevel-edged prongs, *b b*, which pass through a slot in the body of the plane, and by means of a traversing-nut L, inserted between these prongs and a screw-pin K, the fence is fixed in its proper working position, which is when it is in a right line with the outer edge of the cutting iron, as represented in fig. 16. M is the handle, which is made in the same way as the handles of the other tools before described, but is the only part of this tool which is made of wood.

"In all other respects, as regards the materials and the mode of putting them together, the dado plane is the same as the double fillister and ploughing planes."

The *fourth* instrument is a trying plane, suitable for both rough and fine work, and constructed in manner following:—

"Figure 17 is a side elevation of this plane, and figure 18 an end view. Instead of being formed of one piece of wood, as usual, it is composed of four or more separate pieces peculiarly combined together. The part A, which forms the centre, or heart of the plane (lengthwise), is made out of a piece of beech with the grain of the wood running crosswise, as usual. The proper place for the bed and mouth of the plane having been determined, these are cut out, and the two pieces into which the piece of wood is thus separated, are connected together by two side pieces, B B, also of beech, or of any other suitable sort of wood, placed with the fibre running longitudinally and tenoned to the central part A, by means of the tongues and grooves, *a b*. The tongues and grooves should fit closely the one into the other, particularly at top and bottom. The side pieces, B B, are attached permanently to the forepart of A, either by means of screws, as represented in the engravings, or by glueing, or by both screws and glue. At the back part the sides are secured by screws, *c c*, to the inside piece A in such manner that they may be shifted occasionally. W W, are two oblong metal washers, with oblong slots, *w w*, in them, which are let into the side pieces, B B, to such a depth, that when the screws, *c c*, are passed through the slots into the wood, their heads shall be below the surface of the wood. As the sole of the plane becomes worn down by use, and the mouth becomes consequently wider, by slackening or undoing the screws, the back part of the body A can be pushed forward and readjusted, so as to keep the mouth of the plane always of the best working width. The plane iron and its cover are united to each other by means of a nut and screw D, the nut being inserted in a bevelled-sided slot, so as to be nearly flush with the back of the iron; and thus united they are secured to the body of the plane by means of a screw, E (instead of by wedges, as usual), which is passed through the irons into a metal seat F, let into the back part of the centre piece A. C is the handle, which is made like the other handles before described with the grain of the wood at right angles to the length of the plane, and let into and secured in the wood in the manner represented by the dotted lines in figure 17. At the front it is cut away, so as to leave a shoulder, *d*, which rests upon the top of the centre piece A, and at the back there is a sufficient space left to allow of the insertion of a wedge *e*, by driving in which, the handle is firmly secured in its place."

The *fifth* and last improvement consists of a moulding or bead plane, constructed in the manner represented in figure 19, which is a side elevation, fig. 20, which is an end elevation, and fig. 21, which is an under view of the same.

"A A A is the sole of the plane, and B the bed, which are cast together in one piece; C C are totes, or pieces of wood for holding the plane, which are secured to the metal bed, B, by screws; D is the cutting iron, which, like those before described, is secured in its place by a pinching screw, E, passed through a cleft in the head of the iron."

JEFFERY'S MARINE GLUE AS A PREVENTIVE OF FOULING OF SHIPS.

A naval correspondent of the *Times* at Sheerness, states that the *Speedwell* tender to the *Blazer*, whose copper had been covered with Jeffery's marine glue mixed with corrosive sublimate, as a means of preserving her copper, and at the same time preventing fouling at sea, has been brought into dock, and the composition all stripped off, having been found a failure.

This was what every one competent to form an opinion must have foreseen. Jeffery's glue is *perfectly insoluble* in water; it is this property chiefly that constitutes its real value, as an uniting material; but the result of mixing any poisonous matter whatever with a perfectly insoluble resinous cement, is merely to envelope the poison in a water-tight covering, so that it is at once put out of

the reach of affecting either animal or plant; in fact, a piece of Jeffery's glue, mixed with corrosive sublimate, might be *chewed* in the mouth, or even so far as the poison was concerned, *swallowed* with perfect safety. To form a poisonous coating which shall prevent the fouling of a ship's sheathing; and at the same time prevent corrosion of the metal, whether copper or iron, its composition, while fatty, or resinous, must be such, that it shall be slightly soluble in water, and so gradually liberate the poison to act on adherent animals or plants. This is effectually done by Mr. Mallet's patent preparations, of which we gave an account in our 962nd Number, but can never be effected by admixture of poison with Jeffery's glue. Moreover, the poison to which Jeffery limits himself—corrosive sublimate—happens to be one of *the least* destructive of all inorganic poisons to the lower tribes of animals and plants.

STEAM BOILER EXPLOSIONS.

Sir,—It is very possible your pages may have contained much before on the subject on which I am going to address you, but whilst the evil remains, it is, nevertheless, excusable to try to call the attention of the public to the same matter. I allude to the calamitous event of the loss of life from the explosion of a steam boiler on board a steamer at Rio de Janeiro. Now, plainly, had the boiler been surrounded with a double case, or had there been strong bulk-heads at each side of it, the accident would not have been so calamitous, for the explosion, in that case, would have been upwards, and not laterally. What took place lately at Bolton confirms this supposition; for had the steam boiler been in the mill instead of, an adjoining building, the calamity would have been much greater. It appears to me, that the first consideration in building steam vessels, or placing steam engines in manufactories, should always be to make sure, that in the event of explosion, its direction shall be in the way its effects are likely to produce least evil. I recollect reading an account of a steam boiler that gave way, when the explosion carried away the roof of the house, yet two men who were near it were not hurt; for the sides of the boiler, I conclude, remained entire, and it did not act laterally, but like a cannon.

I am, Sir, your obedient servant,

CADOGAN WILLIAMS.

Bridgend, August 6, 1844.

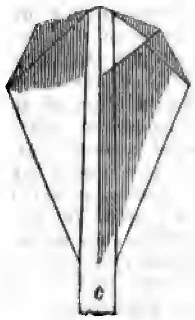
CAPTAIN NORTON'S SUBMARINE SHELL NOT NEW.

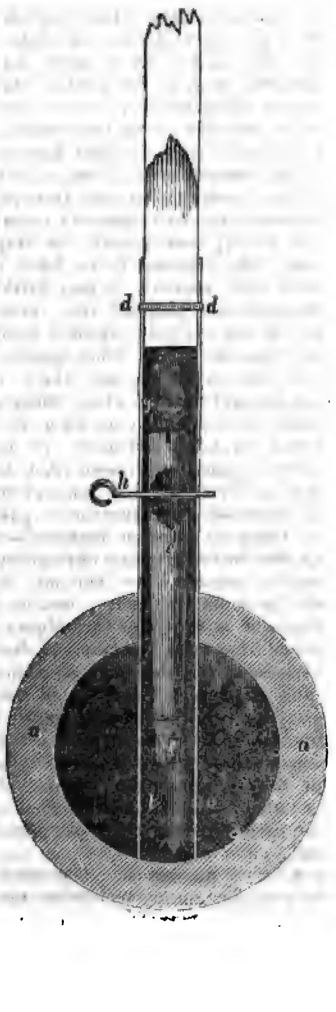
Sir,—In the *Civil Engineers' Journal* for this month, amongst some remarks upon Captain Warner's invention, I observe it stated that Captain Norton has invented a shell to explode on reaching the bottom (of the sea). An iron tube screwed into the shell, and passing into its interior, or across its diameter, contains at its remote end an iron plug of about half a pound weight, fitting it loosely, and having on its end next the shell a percussion cap. The plug is suspended (by a split quill, it is said) in the tube. At the moment the shell strikes the bottom, the iron plug quits its suspension by its inertia, and falling to the bottom of the tube explodes the cap, and fires the shell. It is added that Captain Norton's detonating shells have been tried at Woolwich, and pronounced "safe, simple, and efficacious."

I had a good while since seen it stated in the journals, that Captain Norton's shells had been so tried, but saw no account of their construction. If, however, the account I now quote from, be correct, and if it be true that Captain Norton's shells, so tried at Woolwich or elsewhere, are constructed upon the principle now put forward in his name as new, and his own, for causing a shell to explode at the bottom of the sea—it becomes necessary for me to state, that I am the inventor of the arrangement of exploding shells by the inertia of a loose plug within a tube; and in proof of this I beg to refer to the pages of your journal, for Sept. 29, 1832, in which will be found a paper wherein I first described the invention in full detail. I have to add that Captain Norton was then in Dublin, and having been occupied in contriving other and far inferior forms of detonating shells in company with a Captain Cottingham, I then showed them both, my plan of shell, as described in the *Mechanics' Magazine*, and fired one for them so constructed. The matter having been only suggested to me by the imperfect contrivances of these gentlemen, and being foreign to my immediate occupations, passed out of mind, until recalled to memory by the recent notice of Captain Norton.

Should the present letter meet his eye, he will, I presume, feel called upon to explain how it is that his "safe, sim-

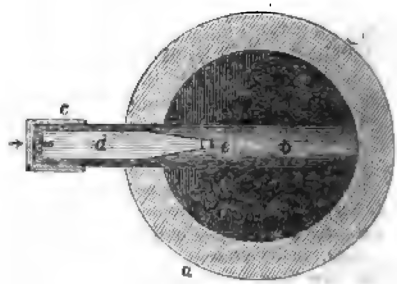
Engravings published 29th Sept., 1832.





ple, and efficacious" shell differs from mine, with which he was acquainted years ago; or, otherwise, how it is that he suffers it, if identical, to pass for his own invention. To prevent any mistake I add a section of the percussion shell proposed by me; and perhaps the editor will be able to favour me by republication of the engravings given along with my original paper upon the subject in the *Mechanics' Magazine.**

Detonating shell by Inertia.



a, the shell; *b*, iron tube; *c*, cap screwed on; *d*, iron plug having a percussion cap on it at *e*, and suspended by a short bit of cord or thread from the cap *c*. The shell being propelled in the direction of the arrow, on its motion being suddenly arrested or retarded, the inertia of the plug *d* breaks the cord or thread, and the cap being struck between it and the shell at the bottom of the tube fires the bursting charge.

In concluding my reclamation of priority, I have only to add that I had no acquaintance with Captain Norton prior to his coming, with his friend Captain Cottingham, to consult me as to their own schemes, nor have I since had any communication with them upon any subject of the kind.

ROBERT MALLET.

Dublin, August 2, 1844.

CAPTAIN WARNER'S INVENTION.

That Captain Warner's mystery is something totally different from a percussion shell of any sort, there can be little doubt. Were it not that there are some circumstances attending the experiment at Brighton, as recorded in the *Times*, of a character so suspicious as to

* We give the engravings referred to in the opposite column.—ED. M. M.

look extremely like a trick, the result would induce one to believe that Captain Warner had really got possession of one of the secrets of nature, unknown to any one else, like Roger Bacon, when he first formed gunpowder, and proposed its use in fire arms; for, as his greater namesake, Lord Bacon, remarks, "There are many such secrets hidden in nature, of powers and virtues manyfold greater and more various than ever man, with all his inventions, hath yet discovered;" but I am uncharitable enough to think that, if ever the "discovery" be made known, it will be simply in the shape of "a discovery of the trick;" in other words that some form of torpedo was fastened to the outside of the vessel before she left the Thames, or was dropped overboard, or was already overboard, and was cast off the steamer at the moment of her most singular and suspicious backing abreast of the destroyed ship.

Can it be stated by any one whether the tow line was dropped off from the ship, and remained in contact with the steamer, and overboard, or *vice versa?*

There are many ways in which a torpedo (or simple box or vessel of powder) close to the ship outside could be fixed, without any communication existing between it and Captain Warner, and hence without interfering with the testimonials of Lord Ingestrie and others. The most obvious is Bushnell's plan of clockwork snapping a gun lock inside after a given lapse of time. Bushnell invented his most ingenious submarine vessel for attaching his torpedo to ships' bottoms during the American war, and it is said did actually blow up a British vessel in the Delaware by it.

Certain it is, that the destructive effects of a given amount of powder exploded close to the hull of a ship in the water, will be greater probably than the same fired or used in any other way; and for this reason, that the water is so good a fulcrum for the instantaneously evolved gases to act upon, that the action of almost the whole sphere of expansion is resolved in one direction, viz., that of least resistance, against the ship; and this blow is almost instantly followed by a second, produced by the resumption of position of the water, rushing into the space cleared by the explosion.

The common military mode of blowing *down* bridges by powder placed loose upon the crown of the arch, and of blowing in strong doors or gates of fortresses by powder bags merely hung against them, are illustrations of the same mode of acting, with powerful effect, when the fulcrum is only air in place of water.

The powerful effect of powder thus exploded, I observed some little time ago well shown in one of the experiments exhibited at that grand toy-shop, the Polytechnic Institution in Regent-street, where the explosion of about half an ounce of powder close upon the bottom of the diving-bell cistern—which I suppose to be about 10 feet deep or so—shook the whole building, so as to be perceptible in the upper balcony, where I was at the moment.

Now it is also certain, that a sufficient weight of powder to destroy the *John of Gaunt* could not by any possibility have been projected even to 300 yards distance without the aid of artillery in some form. Hence, if powder were the explosive agent, it must have been either put overboard, and passed over to the ship by some means from the steamer (probably at the moment she went abreast), or have been already in contact with the ship's hull, and only required to be fixed by some concealed means. It may further be with certainty asserted that, unless powder was the explosive agent, Captain Warner possesses some other agent of explosion known to no one else; for there is no agent in the whole range of chemistry capable of doing, what it is stated his explosion effected. It has been, for instance, suggested that his explosive material is either some of the metallic fulminates or fulminating powders, as those of silver or mercury—or that it is the formidable class of explosive compounds discovered by Dulong, the chlorides or iodides of azote; but those who dream of such vagaries are ignorant of some of the most fundamental facts respecting the properties of those bodies. First, few of these substances will bear to be touched at all without explosion, and none of them will bear a very moderate shock or rub without it; while the chloride of azote is a substance so unstable that it cannot be touched with any solid body, not even a feather, without explosion, and explodes under water, on contact of a variety of bodies. The iodide of azote explodes spontaneously the moment it is washed clean from ammonia,

though still wet on the filter, and does so as soon as it is quite dry, whether free from ammonia or not. Hence, in fact, all these substances are practically impossible to be handled as warlike agents at all. But further, if they were, they would not answer the purpose; for while their explosive violence, (*i. e.* the inconceivably instantaneous rapidity of their explosion) is surprising, the extremely *limited range*, and slight effects of their explosion at a little distance from the mass, is equally so. This arises, first, from the fact, that an explosive matter may explode *too* quickly to do execution; because, to overcome the inertia of solid bodies which are to be rent or projected by an explosion, the latter must occupy some appreciable portion of *time;* for no force can act without time. Thus a cannon bullet passes through a door without moving it on its hinges, or cuts a man in two without knocking him down. Secondly, because the *volume* of gaseous matter evolved at the moment of explosion of all these fulminating substances, is exceedingly less than that evolved from an equal bulk of gunpowder, and is evolved at a greatly *lower temperature,* and hence less expanded at the moment of evolution. These are the causes of the shortness of range which is so striking. Thus Mr. Howard, the original discoverer of fulminating mercury, now so much used for percussion caps, and which has the largest range of any body of this class, found that a charge of it which would burst the barrel, and drive out the breech of a fowling piece, would not propel a ball from it 20 yards. It may be remarked, in passing, that the large percussion caps now used occasionally without powder, to propel balls from a particular sort of small rifle guns, are a mixture of fulminating mercury with gunpowder, or other dividing matter.

Many of the metallic fulminates explode very feebly, which is also the case with the iodide of azote; while the range of the chloride of azote is so exceedingly limited that a globule of it, exploded upon a sheet of thin copper, will indent it about an eighth of an inch, but will not even strike a hole through.

In fact, while gunpowder produces about 300 times its volume of gases, which become expanded by heat to about 1000 times its volume at the moment of explosion, few of these fulminating bodies produce more than one-tenth this volume of gaseous matter.

On the whole, therefore, it is certain that no *known* explosive compound except gunpowder can be Captain Warner's agent; and as a white smoke is said to have been produced, the probability that it *was* powder is greater.

Amongst the agents which chemistry has already placed at our disposal is one which has never yet been proposed as a warlike agent, it is believed; but which bids fair to present one of the most tremendous weapons of naval warfare that has ever been devised. Many years ago a French chemist, named Cadet, discovered a liquid which went formerly by his name, as the liquor of Cadet. He obtained it by the dry distillation of equal weights of acetate of potass and arsenious acid, or common white arsenic. It is possessed of an insupportable odour, and is spontaneously inflammable in the air. This substance has been studied with singular care and perseverance by Professor Bunsen, of Marbourg, who has, in spite of the danger besetting him at every step of his experiments, cleared up the whole history of the subject. He has shown that this liquid of Cadet consists chiefly of the oxide of an organic radical, or compound base, which has a constitution precisely similar to common alcohol, but in which the oxygen is replaced by the metal arsenic. Thus the chemical formula of alcohol is

$$C_4\ H_5\ O,$$

and that of the new radical which has been called cacodyl, in reference to its abominable smell, is

$$C_4\ H_6\ Ar.$$

Now this body possesses the most extreme and rapid spontaneous inflammability, the moment it is exposed to the air, which oxidizes it, and forms the oxide of cacodyl, of which principally Cadet's liquor consists. If, therefore, a fragile vessel of this fluid, say a glass globe, be thrown into the port-hole of a ship, the moment it breaks against the deck, or any hard object, the spilled fluid is in a blaze, and capable of setting on fire anything combustible in contact with it. But this is not all. The result of its combustion is the evolution of clouds of white arsenic, so that the atmosphere around becomes instantly a deadly poison. Thus, if inflamed between decks, the atmosphere would at once be rendered

fatal; for it is well known to toxicologists that a most minute dose of arsenic taken in this form into the lungs is almost certain to produce death more or less speedily. Further, the substance is insoluble in water, and heavier than it; so that water will not extinguish it when on fire. The oxide produced by its combustion, moreover, is a violent poison.

It would be difficult to conceive a collection of more formidable properties in one body, or of any more fitting it for an agent of destruction in warfare. It is not impossible that this may have been the celebrated Greek fire of the middle ages, the secret of which has been lost (see Gibbon). It was said to be a fluid.

R. M.

FULTON—SYMINGTON.

Sir,—It would appear from the account given in your last number of Fulton's torpedos or contrivance for blowing up ships, and his art of navigating under water, &c. &c., that he had met with more success than Captain Warner's project has hitherto done, so far, at least, as "*humbugging*" is concerned; for, according to Dr. Cartwright's biographer, he practised so successfully upon the credulity of the ministry then in power, that he actually succeeded in extracting from them a considerable sum of money to suppress his wonderful and destructive secret. After playing his cards to such good purpose, it is said, he shortly afterwards returned to America, and in the following summer (1807), "had the satisfaction of seeing accomplished his long-cherished and favourite project of launching a steam-boat in his native country."

Far be it from me to attempt to depreciate the merit of Mr. Fulton's projects or wonderful ingenuity, but I "*calculate*" that Mr. Fulton, after having (in July 1801) been carried a distance of eight miles in one hour and twenty minutes on board of Symington's steam-boat, the *Charlotte Dundas*, when he had every explanation given of the mode of arrangement and working of the machinery, and was allowed to take such sketches as he thought proper, may, without being over presumptuous, have cherished with no small degree of confidence, the hope of being able to see the launching of a steam-boat in his native country. Like Columbus with the egg,—once shown the way, nothing was easier.

I am, Sir, yours, &c.

SCOTUS.

[The reference in the preceding letter to Symington, from whom it is now matter of unquestioned history, that Fulton borrowed his steam navigation plans, reminds us that we have omitted to notice in our pages the recent death of the widow of that most meritorious, but ill-requited person. Mrs. Symington, who was in every respect a lady worthy of the name, cherished to the last the hope that Government would sooner or later recognize the claims of herself and family, to some token of public gratitude for the incalculable services rendered by her departed husband to steam navigation; and died with that hope still strong upon her. When it was proposed two or three years ago through our pages to make up for the neglect of Government by private subscription, the plan was discouraged by some influential friends of the Symington family, from an idea that it might interfere with, and prejudice an appeal that had been made in their behalf to ministers. No doubt they acted to the best of their judgment, but events have not yet shown that they acted for the best. Two sons and a daughter survive; one of the former, a gentleman well-known to our readers, as fast gaining for himself an honourable name in mechanical science, by inventions of his own, from which it is to be hoped he may ere long reap fortune as well as fame.—ED. M. M.]

THE VESTA LAMP.

Sir,—Seeing Dr. Ure's very flattering recommendation of Young's Vesta Lamp in one of your recent monthly parts, I was induced to purchase one, but regret to say, that it does not answer the expectations formed of it. The smoking (however much care is taken) is, in consequence of the uneven burning of the wick, intolerable after being left an hour or two, and although, in reply to Mr. Young's agent of this place, Mr. Young has given us "further directions," yet we are as far off as ever from obtaining a pure and smokeless light. Mr. Young directed the camphine to be put into the lamp nightly on the surface of some water, but this we find will not answer, as the wick gets so far saturated with water as to render it incapable of imbibing the camphine, and at times the light goes completely out with this arrangement. As the light is certainly a great acquisition to the family circle, *when it will burn*, myself and friends would be obliged to any of your correspondents who may have it in their power to "enlighten our darkness."

I am, Sir,

Yours most obediently,

S. B. J.

Peckham, August 1, 1844.

ENUMERATION OF THE FIXED STARS VISIBLE TO THE NAKED EYE IN EUROPE, DISTINGUISHED INTO THE SEVERAL CONSTELLATIONS AND CLASSES OF MAGNITUDE. FROM THE RECENT OBSERVATIONS OF PROFESSOR ARGELANDER, OF BONN.*

Constellations.	1	1·2	2·1	2	2·3	3·2	3	3·4	Fourth.	Fifth.	Sixth.	Total.
Ursa Minor........	..	..	..	$\alpha; \beta$	..	..	γ	..	0,0,3	1,3,1	2,14	27
Cassiopea..........	..	..	..	γ	β	..	δ	ε	1,3,2	2,10,2	6,36	66
Camelopardus......	..	..	..	..	..	..	..	..	0,2,1	4,15,3	8,50	83
Draco.............	..	..	..	..	γ	$\beta; \eta$	$\delta; \zeta; \iota$	$\alpha; \kappa; \lambda; \xi$	2,2,4	4,20,11	14,63	130
Cepheus...........	..	..	..	..	..	α	β	γ	3,1,2	5,6,7	12,49	88
Perseus...........	..	..	..	α	..	..	$\gamma; \delta; \zeta$	ε	2,9,3	1,19,3	3,32	77
Auriga............	α	..	..	β	..	..	$\vartheta; \iota$	ε	1,2,1	1,15,4	5,35	69
Lynx..............	..	..	..	..	..	..	..	40	0,1,0	2,8,0	1,29	42
Ursa Major........	..	..	..	$\alpha; \varepsilon; \zeta; \eta$	$\beta; \gamma$	..	$\vartheta; \iota\ \mu; \psi$	$\delta; \kappa; \lambda; \nu; o$; h	2,2,0	4,28,1	1,84	138
Canis Venatici......	..	..	..	..	..	..	12	..	0,0,1	1,11,3	2,34	53
Bootes............	α	..	..	..	ε	γ	$\beta; \delta; \eta$		3,4,4	7,13,1	1,45	85
Corona Borealis.....	..	..	..	α	..	..	..	..	2,3,1	3,4,0	3,8	25
Hercules..........	..	..	..	..	β	ζ	$\gamma; \delta; \eta$	$\varepsilon; \iota; \mu; \pi; \tau$	2,6,8	1,21,5	5,94	152
Lyra..............	α	..	..	..	..	..	..	γ	0,1,4	2,3,4	5,26	47
Cygnus............	..	..	α	..	..	$\gamma; \varepsilon$	$\beta; \delta; \zeta$	..	6,10	4,14,15	17,71	143
Lacerta...........	..	..	..	..	..	..	..	..	0,1,1	2,7,1	1,18	31
Andromeda.........	..	..	..	α	$\beta; \gamma$	..	..	δ	1,7,4	1,11,6	2,46	82
Circumpolar Const...	3	0	1	11	8	7	25	23	118	320	822	1338
Pisces............	..	..	..	..	..	..	..	α	1,7,3	6,10,4	7,36	75
Triangulum........	..	..	..	..	..	..	β	..	1,0,1	0,1,1	4,6	15
Aries.............	..	..	..	α	..	β	..	..	1,1,3	0,7,3	7,26	50
Taurus............	α	..	..	β	..	..	η	$\zeta; \lambda$	3,6,5	5,14,7	12,64	121
Orion.............	$\alpha; \beta$	..	..	$\gamma; \delta; \varepsilon; \zeta$	..	κ	ι	$\eta; \lambda$	1,4,1	10,12,6	9,62	115
Gemini............	..	β	α	..	γ	..	μ	$\varepsilon; \delta; \eta; \vartheta$	3,2,1	2,9,2	6,19	52
Canis Minor.......	α	..	..	..	..	..	β	..	0,0,0	0,2,2	0,9	15
Cancer............	..	..	..	..	..	..	..	..	1,3,1	1,3,0	1,36	46
Leo...............	..	α	..	$\beta; \gamma$	δ	..	$\varepsilon; \zeta$	$\eta; \vartheta$	1,4,3	3,16,0	0,40	75
Leo Minor.........	..	..	..	..	..	..	..	..	0,1,2	2,6,0	0,10	21
Sextans...........	..	..	..	..	..	..	..	..	0,0,1	0,5,0	0,11	17
Cuna Berenices......	..	..	..	..	..	..	..	..	0,1,2	1,14,1	1,16	39
Serpens...........	..	..	..	..	α	..	η	$\beta; \delta; \varepsilon; \mu$	3,1,1	4,5,0	0,30	50
Ophiuchus.........	..	..	..	α	η	ζ	$\beta; \delta$	$\varepsilon; \vartheta; \kappa$; 72	3,1,3	2,20,1	0,32	71

Aquila............	..	α	..	..	..	..	γ; ζ; ϑ	δ; λ	0,2,2	2,14,4	10,41	81
Vulpecula..........	..	..	..	..	..	..	..	..	0,0,1	2,9,4	6,15	37
Sagitta............	..	..	..	..	..	..	..	..	1,1,2	0,1,1	0,10	16
Delphinus..........	..	..	..	..	..	..	..	β; γ	1,2,0	1,1,0	4,9	20
Equuleus..........	..	..	..	..	..	..	..	..	0,1,0	2,2,0	0,8	13
Pegasus............	..	..	..	α	β; ε	γ	η	ζ; ϑ	0,5,1	4,15,4	20,51	107
Middle Zone........	4	3	1	10	6	4	14	25	95	253	618	1033
Cetus............	..	..	..	β	α	..	ζ; η; ϑ	γ; ι; τ	0,5,2	7,8,7	7,53	97
Eridanus..........	..	..	..	..	..	..	β; γ; δ; ε; η	ν; 12	5,8,4	5,11,7	6,40	93
Lepus............	..	..	..	..	..	..	α	β; μ	3,2,2	0,6,2	1,3	22
Columba..........	..	..	..	α	..	..	β	..	0,3,0	0,0,1	0,0	6
Monsceros..........	..	..	..	..	..	..	..	..	1,1,3	3,7,4	5,40	64
Canis Major........	α	..	ε	δ	..	β; ζ; η	..	o²	0,1,3	4,10,0	6,7	38
Argo Navis.........	..	..	..	..	..	..	ι	..	1,2,1	1,10,2	10,13	41
Hydra............	..	..	..	α	..	..	γ	ε; ζ; ν	1,6,3	4,13,2	10,30	74
Crater............	..	..	..	..	..	..	..	δ	0,3,1	0,2,0	2,5	14
Virgo............	α	..	..	..	..	γ; ε	δ	β; ζ; η	1,4,4	3,16,1	1,62	99
Corvus............	..	..	..	γ	δ; β	..	ε	..	0,1,0	0,2,0	0,8	15
Centaurus..........	..	..	..	..	..	..	ϑ; ι	..	0,0,3	1,1,0	0,0	7
Libra............	..	..	..	β	α	..	..	..	0,0,1	3,6,0	0,16	28
Lupus............	..	..	..	..	..	..	..	..	0,0,0	1,1,0	0,0	2
Scorpius..........	..	α	..	β	δ	..	ε; λ; π	γ; σ; τ	0,3,3	1,7,0	0,8	31
Sagittarius.........	..	..	..	..	σ	ε	λ; π	γ; δ; ζ	2,5,0	3,13,0	1,21	52
Scutum Sobies......	..	..	..	..	..	..	..	..	0,0,1	2,3,0	0,4	10
Capricornus........	..	..	..	..	..	..	β; δ	α	1,2,3	3,8,6	2,17	45
Aquarius..........	..	..	..	..	..	..	α; β; δ	ζ	3,5,6	10,9,8	10,41	96
Piscis Australis.....	..	α	..	..	..	..	..	..	0,2,1	5,6,2	1,1	19
Southern Zone......	2	2	1	7	6	6	26	23	112	237	431	853
Visible Heavens.....	9	5	3	28	20	17	65	71	325	810	1871	3224

OTHER OBJECTS VISIBLE TO THE NAKED EYE. *Variable stars*, α Cassiopeiæ, δ Cephei, β Persei, P. *xv.* 185 Coronæ Borea Borealis, α Her-

* Having been requested by a scientific society—who had purchased a pair of large globes, which they were desirous of using to some better purpose, than merely to look at—to furnish them with a catalogue of the stars up to those of the 6th magnitude, and believing that the publication of such a catalogue would be generally useful to other institutions, as well as that by which the request has been preferred, and also to academies, tutors, &c., we are happy to be now enabled, through the obliging co-operation of our esteemed correspondent Mr. Woollgar, to supply the same. The catalogue, it will be seen, is compiled from the recent Celestial Maps of Argelander, whose magnitudes have been adopted in the new Greenwich catalogue just out, which speaks sufficiently in their favour.—ED. M. M.

culis, B Lyræ, χ Cygni, P. ix, 176 Leonis, η Aquilæ, o Ceti, P. xiii. 94 Hydra, * Virginis, R.A. 187° 36′ N.D. 7° 52′ * Scuti Sobieski R.A. 279° 44′, S.D. 5° 52′. In all, 13.

Clusters of Stars. In Camelopard, 1; Perseus, 3; Canes Ven, 1; Cygnus, 1; Gemini, 1; Cancer, 1; Ophiuchus, 2; Monsceros, 2; Canis Major, 1; Argo, 1; Sagittarius, 1. In all, 15.

Nebulæ. In Hercules, 2; Andromeda, 1; Pegasus, 1. In all, 4.

Observe. In the preceding Table, a scale of intermediate magnitudes is adopted, which has been used by many astronomers from Flamstead's time. Thus, 1, 2 signifies a star of the first magnitude, but of inferior brightness to the average of that class; 2, 1 denotes a star of the second magnitude, of greater brilliancy than the generality of stars so denominated. As far as the first three magnitudes extend, each star is specifically denoted by its Greek letter; for the 4th, 5th, and 6th magnitudes, only the numbers of each are expressed, regard being still had to the subdivisions; thus, against Cassiopea, under the column "Fourthly," are the figures 1, 3, 2, implying that there is one star of the 4·3 magnitude, 3 of the 4th, and 2 of the 4·5.

J. W. W.

CASE OF MR. WITTY, THE INVENTOR OF THE OSCILLATING STEAM-ENGINE.

Sir,—It is seldom that the authors of new inventions derive much benefit from their discoveries, even when protected by a patent, though the inventions themselves prove, ultimately, of the greatest advantage to the public. Compensation for the expense of carrying them out, and the time and trouble required for bringing them into full operation, is not always to be accomplished within the ordinary limits of patent rights. A striking exemplification of this is to be found in the case of a distinguished engineer, whose name has frequently appeared in your pages, and in the other scientific works of the present age, Mr. Richard Witty, of this town—the inventor and patentee of the vibrating or oscillating steam-engine, and of many other useful inventions which are flourishing, and producing abundance of fruit, whilst he, the author of them, after spending his best days in the cause of mechanical science, is, in his old age, (for he is now upwards of 70,) in a state of pecuniary distress.

Mr. Witty took out the patent for the oscillating engine in the year 1813; and devoted much labour and expense in bringing it to perfection; but, in the meanwhile, the years passed away without yielding him the expected remuneration, and now that it has become public property—indeed, I may say a national benefit,—nothing is left to him but the honour of the invention.

It is calculated that not less than 6000 horses' power of Witty's vibrating, or oscillating steam-engine are now *at work* on the Thames, Clyde, Tyne, Humber, &c., being peculiarly adapted to steam vessels. Dr. Jamieson, in his Dictionary of Mechanical Science, observes emphatically, "The name of Witty will never be forgotten, while the steam-engine is remembered, or we shall retain its use."

My object in addressing you is to bring the matter before the scientific world, in hopes that something may be done to gild the evening of his days. I need not, I think, add more to excite sympathy on behalf of a very worthy man, and remain, Sir,

Your most obedient servant,

MERCATOR.

Hull, June 26, 1844.

We beg most earnestly to recommend the subject of the preceding letter to the generous consideration of our numerous readers. From a subsequent communication which we have received from the writer, we learn that the strong claims of Mr. Witty having been brought under the notice of the Corporation of the port of Hull, which has benefited so largely by steam navigation, the members, while they regretted that they could not in their corporate capacity vote any grant of money, immediately set on foot an individual subscription, which is now open to contributions from the friends of inventive genius in all parts of the country.* Let us hope that so good an example will not fail of its desired effect.

We have thought that we could not better promote the success of this subscription than by collecting together such proofs as are within our reach of the services which Mr. Witty has rendered to mechanical science; and the result we now lay before our readers.

We find from our registry that there are

* Subscriptions will be received at the Offices of the *Mechanics' Magazine*, 166, Fleet-street, London, and *The Advertiser*, Hull, or they may be remitted directly to Mr. Witty, Hibb's-buildings, Osborne-street, Hull.

no less than ten different patents standing in Mr. Witty's name; 3 for steam-engines; 2 for gas-burners; 1 for a syphon pump; 1 for a steam-carriage; 1 for a gas-furnace; 1 for tubular flues for burning smoke; and 1 for improvements in the construction of bridges and roofs. The money expended in securing these patents alone, or, to speak with literal truth, the *fines imposed upon him* by a *paternal* and *enlightened* government for his unceasing endeavours to benefit his country, must have amounted to a sum that would have purchased him a handsome annuity for life, and quite superseded the necessity for the present subscription.

The most important of Mr. Witty's inventions was undoubtedly the oscillating engine. It was included in the third of his steam-engine patents, which is dated the 5th June, 1813; and the following is a literal copy of so much of the specification as relates to it.

Fig. 12.

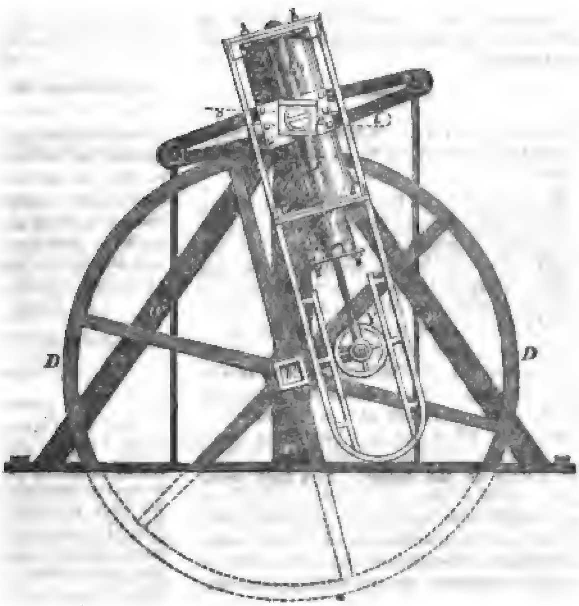
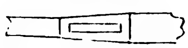


Fig. 13.



"Fig. 12 is a cylinder with side pipes, EE, conical collar and axis. The steam pipe *s*, with throttle valve *i*, and eduction pipe *o*, and the beam for working the necessary pumps are seen in this figure. Instead of the cylinder moving quite round as in the other engines before described, it is made to vibrate through an arc or portion of a circle, its piston rod having a friction wheel, Y, with slide bars for it to run upon (in common with those engines before described in this specification) to keep it parallel, and is connected with a crank or equivalent contrivance fixed on the axis or shaft, V, of a common fly-wheel. D D, the axis of the vibrating cylinder is supported by a frame, W W. As the movement by thus vibrating as described, is much less than when the cylinder revolves, it is necessary to make the holes in the axis and concentric collar much longer, extended lengthwise, as seen in the axis fig. 13, to allow a sufficient aperture for the steam to pass. The alternations, or changes, or the openings and shuttings take place when the cylinder is in a vertical position. In this construction the work to be done by the engine is connected with the axis, V, of the fly-wheel, D D, which may be made to work the pumps instead of the beam, shown by my drawing. The engine may be made to revolve either way, by reversing the communication of the steam; and eduction, by valves and corresponding pipes."

EXTENSIVE LOGARITHMIC TABLES.

A volume of tables has been stereotyped at Edinburgh, in imperial octavo, comprising Logarithms of Numbers to 120,000, Anti-logarithms to ·100000, and Logarithmic Sines and Tangents to every second of the quadrant—all to seven places, together with auxiliary apparatus, and some other tables. The work is essentially a combination of Taylor's and Dodson's in a condensed form. The editor is Lieutenant Robert Shortrede, at whose sole expense the work has been prepared. Messrs. Sang and Galbraith have acted as sub-editors. The volume is not to be published until it has been examined by some of the leading mathematicians, British and Foreign.

STEAM ELECTRICAL MACHINES—SCREW PROPELLING—MARINE LIFE-PRESERVERS.

Sir,—It occurred to me, while intending to construct a steam electrical machine, that the great inconvenience arising from the insulation of the boiler, might be remedied by simply attaching the apparatus with the box-wood tubes to the boiler by a thick glass tube. Glass would surely stand the pressure required; it might be very short, and as near as possible to the heat of the boiler to keep it dry. Besides the simplicity of this plan, it seems also to promise an increase of effect, for less electricity must escape along that one dry tube, than from all the points on the boiler. At a high pressure the tube must be shortened, and the loss of electricity increased; but I think the convenience to a lecturer,—who might have his common boilers fitted with a glass tube,—would compensate for any trifling difference in effect.

Since the re-action of the screw has answered so well, why is it not more applied directly? For instance, in producing the vacuum in the atmospheric railway, where a rotary-engine revolving at immense speed could work a screw at any velocity *on its own axis.* Indeed, why not have that rotary-engine *another screw,* itself worked by steam? I am about to make a model steamboat with Ericsson's propeller, on the axis of a screw in a cylinder worked by steam. Perhaps, Mr. Editor, some of your readers would favour us with their opinion as to the probable success of this plan.

The expense of the air-bags, proposed to be applied to ships some time ago in your Magazine, would, I fear, deter any one from using them; but I have often thought that a supply of water-tight cloth or canvass in its simple state would be of eminent use in time of danger. By this, those constant resorts in shipwrecks—the hencoops—might soon be covered, and made to support many in the water. The boats when taken to as a last resort, might have their sails of this, and be thus enabled to stop those constant leaks, that a heavy cargo of human beings produces, while the simple nature of this life-preserver would allow of its being nailed on to the nearest frame by any landsman.

I am, Sir,
Your obedient servant,
J. M.

July 15, 1844.

EFFECTUAL METHOD OF PRESERVING FURS.

Sir,—Your journal directs that furs should be washed on both sides with a mixture of corrosive sublimate dissolved in half-a-pint of spirits of wine. The proportions not being given, I beg to state that 15 grains is sufficient; I may also add that it will dissolve in water, particularly if warm, as well as in spirits of wine.

I am, Sir, &c.,
J. B.

August 7, 1844.

NOTES AND NOTICES.

Chapel on Wheels.—The Wesleyan Methodists, of the Bingham circuit, have erected a movable wooden meeting-house upon wheels, capable of seating about 120 persons, at a cost of about 60*l.*, for the accommodation of several villages where no site could be obtained. The above place of worship was opened on Monday last by Mr. John Shelton, of Nottingham, who preached two sermons upon the occasion. At the conclusion collections were made, amounting to upwards of 50*l.*—*Manchester Advertiser.*

Electro-Magnetic Communication between England and the Channel Islands.—Mr. Warner, a correspondent of the *Jersey and Guernsey News,* proposes that an electro-magnetic telegraph should be established between Portsmouth and St. Heliers. "The expense of such an undertaking would not be so great as perhaps at 'first blush' might appear. Wire is an unexpensive article, and might be spun out to any length required: two threads only would be requisite for the purpose. The distance from Jersey to Portsmouth is 136 miles; allow ten or a dozen more for the inequality of the submarine surface, as also for contraction of the wires, which should be by no means stretched to their extreme tension—quite the reverse. The expense of the wires alone would be a mere trifle; but then comes that of encasing and securing them, by some cheap anti-corrosive material, from the action of salt water, as also to give them strength and durability. This, it must be admitted, would be of far more cost than the wires themselves; to which must be added the weights at certain intervals, for sinking the wires, and preventing oscillation as much as possible: all these, however, might be estimated at a moderate ratio of expense per mile."

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1097.] SATURDAY, AUGUST 17, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

ROWAN'S REGISTERED CHURN.

Fig. 1.

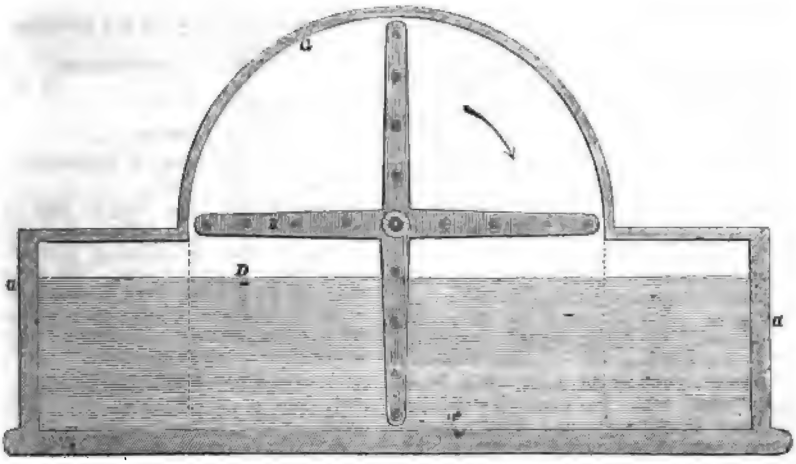
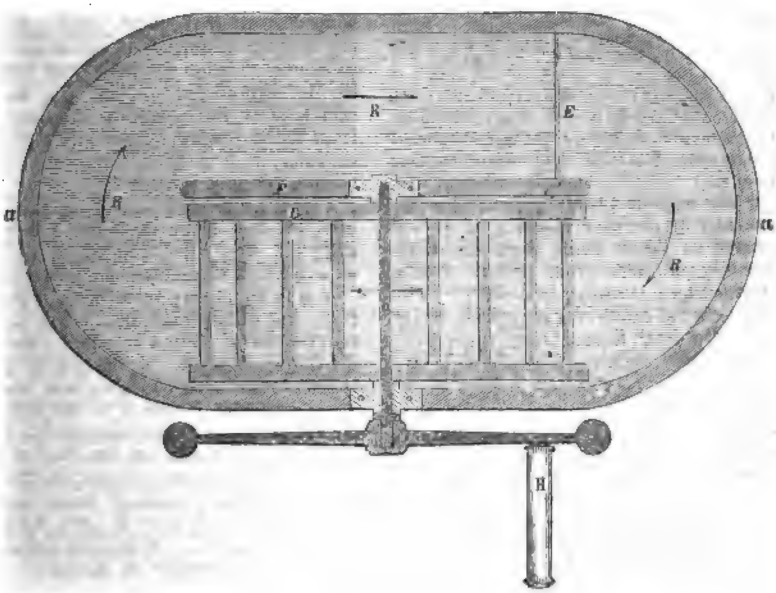


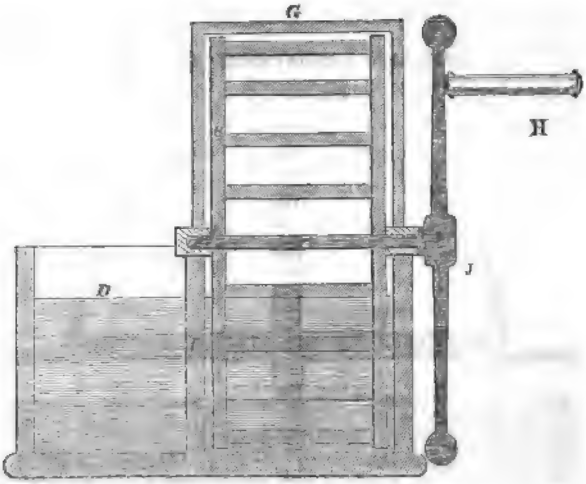
Fig. 2.



ROWAN'S REGISTERED CHURN.

[Registered under the Act for the Protection of Articles of Utility. Andrew Rowan, of the firm of John Rowan and Sons, of the Doagh Foundry, Ballyclare, Inventor.]

Fig. 3.



From several experiments which have been made with this churn by Butter Societies in the north of Ireland—a new class of institutions originating in a laudable desire to improve the manufacture of butter, for the production of which the rich pastures of the Green Isle render her so peculiarly fitted—it appears to be well established, that it possesses several decided advantages over every other churn yet in use. The butter produced, is not only more abundant in quantity, but of a much better quality than that made in the ordinary way. In one experiment, twenty gallons of milk, churned by the new machine, gave six ounces of butter more than the same quantity of milk from the same cow churned by a common box churn. The former lot of butter was also much firmer and of a finer flavour than the other; nor was the firmness attended with any of that toughness common to Irish butter as ordinarily manufactured. The reasons given for these favourable results are, no doubt, the true ones:

First, with the ordinary close machines the temperature of the cream has to be raised by the addition of warm water to 68° before the butter will separate from the milk; while, with the new machine, the butter separates from the milk at 58°—a reduction of temperature, owing to the circumstance of this churn being partially open at the side to the atmosphere, and to there being a constant current of fresh air through it; and, *secondly,* after the butter separates from the milk in the common machines, it continues to be banged about by the flyers, till the churning is over, acquiring unavoidably that toughness so much complained of; while, in Mr. Rowan's churn, as soon as the butter parts from the milk it passes off from the flyers and lodges on a receiver, or sluice, as it is called, where it may be taken away as it is made.

Fig. 1 is a ground plan of the machine with the top cover of flyers removed. Fig. 2, a side view, and fig. 3, an end view through the centre of the flyers.

a a is an oblong vessel with rounded ends, but which may be of any other suitable form. F is a standard raised in the centre of this vessel, leaving an open space at each end. C is an axle, which is supported on bearings in the side of the vessel A, and in the standard F. B B are the flyers, which are attached to the axle C. G is the top cover of the flyers. J is a fly-wheel, which is fixed on the outer end of the axle C, and worked by the handle H. When commencing to churn, the vessel A is filled with cream up to the line D, figs. 2 and 3. The top cover, G, is next placed over the

flyers. Motion is then given to the flyers by the handle H, which displaces the cream under the flyers, and causes a circulation round the channel R R R, in the direction shown by the arrows. When the butter begins to part from the milk, this is a signal for the person in attendance to push down the sluice E a little below the surface of the milk, on which the butter collects in front of the sluice. The operation of churning is continued as long as butter is seen to gather at the front of the sluice.

FOREIGN SCIENCE.

Oxides of Copper.

There are two known oxides of copper, which with British chemists are known as the suboxide, whose formula is $Cu_2 O$, and the protoxide or black oxide, which alone combines to form salts, and whose formula is $Cu\ O$; this is the binoxide of foreign chemists. Up to a late period no other oxides of copper were presumed to exist. Some time ago, however, Dr. Lyon Playfair announced that he had formed a higher oxide,—a cupric acid in fact,—at a meeting of the British Association in Manchester; but no particulars have since been given to the public. A memoir has recently been published by MM. Favre and Maumené, in which they show that, when the black oxide is strongly heated *per se*, it is not merely fused, as was hitherto supposed, but is resolved into metallic copper, and a new oxide, whose composition is $Cu_8 + O_5$. Its fresh fracture is reddish, and in powder it is nearly as red as the protoxide, or suboxide of English chemists, while its surface, by absorption of oxygen, speedily becomes black, and converted back into binoxide.

This is an important fact, both as regards the usual mode of estimating copper in inorganic analysis by the binoxide, and in the use of this oxide as an oxidizing agent in organic analysis.

New Mode of Variegating Metallic Surfaces.

A new art for the ornamenting of the surfaces of works in metal has lately been proposed by Becquerel, and a long memoir on it presented by him to the Academy of Sciences of France, in which he details all the principles and instructions necessary for the manipulation of the art.

It consists in the production of certain stains or colourings of great beauty upon metallic surfaces, by the precipitation upon them of an indefinitely thin coat of peroxide of lead, by the aid of galvanic arrangements.

A saturated solution of protoxide of lead is made in caustic potass of a certain degree of density, and from this the peroxide of lead is deposited upon the positive pole of a galvanic arrangement of a few pairs of plates. The stains are produced in coloured or irridescent rings, like those optically produced, and known as Newton's rings; and by stopping out any desirable portions of the surface in form of arabesque or other designs, combinations of great beauty may be effected. The only difficulty appears to be, that the stains are somewhat easily detached by friction; but this may probably be remedied by heating and lacquering. The process seems worthy the attention of some of the Birmingham manufacturers.

French Indigo.

Great efforts are making in France amongst the agricultural interests to promote the growth of the *Polygonum tinctorium*, as a tinctorial plant, and a substitute for indigo. This was one of Napoleon's hobbies, and intended by him, as it is now, to make France as independent of England and her colonies as she can be without successful colonies of her own; and if the same wonderful scientific skill, mercantile energy, and encouragement for a time, be bestowed on this, that was given to the beet-root sugar manufacture, there is every reason to suppose that our sales of indigo in France may be hereafter greatly curtailed, if not annihilated.

Mud of the Nile.

The mud of the Nile has an historical celebrity. On its annual deposition the fertility of Egypt was and is dependent. In 1812 an analysis of this mud, by Regnault, was published in the memoirs of the commission of Egypt. He announced the existence of six per cent. of carbon in it. Recently, Lassaigne, having been consulted by M. de las Cases as to its true composition, has submitted it to a new examination and analysis, with different results. He finds its specific

gravity is 2·385, which does not differ much from that of good arable soil. It exhales ammonia when heated in a tube. By heating with potassium, lixiviating, filtering, and treating with hydrochloric acid and deuto-sulphate of iron, he obtained a blue precipitate; thus, by the formation of cyanogen, demonstrating the presence of nitrogen in the mud.

The mud yields ulmates or humates to solutions of caustic alkalies.

The constitution of the mud he states to be,

Silica	42·50
Alumina	24·25
Peroxide Iron	13·65
Carbonate lime	3·85
Carbonate magnesia	1·20
Magnesia	1·05
Ulmin acid and azotized organic matter	2·08
Water	10·70
	100·

The inorganic principal constituent of this mud, therefore, may be viewed as a silicate of alumina ($Al + Si_2$).

Its agricultural value, therefore, depends upon its *fresh* annual deposition upon its azotized and other organic matter, and upon the relation its aluminous constituents bear to the sandy soil on which it is deposited.

French Atmospheric Railway.

The French are certainly respectable *savants*, but very singular specimens of practical engineers. A good instance of the character of many of their inventions is to be had in a project lately brought forward by M. Faulcon, for a new atmospheric railway. In this, propulsion is to be performed, not by exhaustion, but by condensation of air into a tube, under the following arrangement:—In the middle, between the rails, is laid down a continuous broad flat surface of timber, flags, iron, or such like material, of 12 inches wide or so; upon this lies a continuous hose pipe of any strong air-tight material, whose diameter is not stated, but is presumed to be large. The leading carriage is rigidly connected with a broad-faced wheel, which rolls along upon the upper surface of this hose, when in a state of complete collapse, or lying flat on the continuous way. Things being so, if air or other fluid, elastic or not, be pumped into the hose *behind* this wheel, it will become inflated, and as the condensation proceeds will push on the wheel, which will roll along upon the pipe, forming, as it were, a travelling diaphragm between the filled and empty parts of the hose-pipe! This scheme, whatever other objections it is liable to, and these are obvious enough, is liable to that which has always hitherto prevented (as in the hands of Papin) the transfer of power to a distance, by simply condensing air into a close tube; viz., the rapid increase of friction, and the resistance produced by the packing up of the air in the tube itself.

New Turbine.

A new turbine has been invented by Mr. Koechlin, which he calls the double acting turbine. No details of the plan are published as yet, but several of the machines are stated to be at work in Alsace, and one at Aspach le Pont, which has been the subject of a report addressed to the Industrial Society of Mulhausen. A commission of the Academy of Sciences, composed of Poncelet, Lamé, and Morin, has been appointed also to report upon it. It is very strange that so little attention has been hitherto given in Great Britain to this important class of machines, especially in our mining districts, and other parts where great falls with small volumes of water exist. The return of power from this machine of Koechlin's, is stated to be from 55 to 85 per cent. of the power of the fall; but this is not more (we believe) than the wheel of our own ingenious countrymen, Whitelaw and Stirrat, has under some circumstances realized.

Hydraulic Mortar for Marine Works.

M. Vicat, whose continued researches upon mortars and cements are so well known, has recently been engaged in some new investigations, with respect to the sorts of poor limestone which will answer for hydraulic mortar to be used in sea water, it having been found that certain sorts of hydraulic mortar used at Algiers, which stood well in fresh, would not at all answer in the sea-water of the Mediterranean—which, it appears, contains more sulphate of magnesia and chloride of magnesium than the sea-water of the ocean or British seas. Vicat announces, that all clays which contain enough of carbonate of lime to form

after burning (calcination) a silicate of alumina and lime in any proportion whatever, but in which the lime shall be at least the one-tenth part of the alumina attacked by it, will answer for marine pouzzolanas."

Only, he says, no more heat must be applied to them in the burning than is just sufficient to decompose the carbonate of lime, and reduce it to a silicate. When clays of such a constitution cannot be had, he adds, that 5 per cent. of caustic potass added to pure clays, (viz., clays free from lime, but containing finely divided silex,) will answer as well after burning. Vicat says he has invented modes of burning to avoid too great or too long a heat, but he has not described them.

Gunpowder that won't explode until it is wanted.

When Swift wrote the satire upon the philosophers of his day, in his Island of Laputa, and proposed something very like to the above, amongst the other projects of his academicians, such as bottling sun beams to rear cucumbers in winter, he had little notion that he was so near a problem that would one day be solved. M. Piobert may be considered the inventor, and M. Fadeeff the perfector of this invention. To make ordinary gunpowder inexplosive, all that is necessary is, to mix it with a small proportion of finely pulverised wood charcoal mixed with plumbago in equal bulks. The gunpowder is mixed with these in such proportions, that 33 parts in bulk of powder become 49 parts of the mixture. In this state the mass is still inflammable, but it burns slowly, like a squib, and will not explode. To bring the powder back to its former condition, it is only requisite to sift it through a fine sieve, to separate the fine charcoal or carbo-graphite powder, and it is forthwith as explosive as usual.

The inventors have made experiments upon this on a great scale. The combustion of a whole barrel of powder thus treated only produces a flame from the head about 5 feet high, and which may be safely approached.

Water will extinguish this combustion readily, and the mixture of the carbo-graphite with the powder is found to be much less hygrometric than powder alone, so that this means of safety may be adopted in magazines, not merely without injury, but with positive benefit to the powder.

Compounds of Chrome—Beautiful Red Colour for Glass.

Doctor Kopp has lately published some interesting experiments upon some of the compounds of chrome. He finds the sulphate of chrome, $3\ S\ O_3 + Cr_2\ O_3$, is perfectly insoluble in water, and hence he proposes to use this property as a means of separating chrome from the oxides of all those metals whose sulphates are soluble, as zink, magnesium, &c. It may be questionable whether double sulphates may not form, however, and derange the result. He finds this body is wholly reduced by hydrogen, and gives rise to a pyrophorus more intense than any heretofore known.

In this reduction all the oxygen, and one-half the sulphur, fly off, leaving a new compound of sulphuret of chrome, whose constitution is $Cr_4 + S_3$. Kopp believes, also, that he has obtained another sulphuret of the constitution $Cr_2 + S$, which has got the valuable property of colouring flint glass of a most intense red, so intense as to be almost opaque, if in large proportion to the glass; thus, like the oxides, the compounds of higher doses of sulphur, colour glass green, and the lower ones red.

It is probable this fact may be of great value to the manufacturers of glass, to whom a fine red glass, equal to that of ancient church window glass, is still a desideratum.

Kopp's results are published in extract in the *Comptes Rendu*, for last month.

Purification of Fish Oils.

MM. L'Heretier and Dufresne have given to the public, in *Jobard's Journal*, the results of their labours for the purification of fish oils for lamps and soap making. They state that the foulest fish oil, treated by their methods, become fitted for either use. The processes are briefly:

1. Submitting the oil to the action of water and a little caustic potass, with heat—to decolorate and suspend the mucilage.
2. Passing a current of steam through it to precipitate the mucilage.
3. Treating next with sulphuric acid and animal charcoal to complete the decoloration.

4. Treating with chloruret of lime and sulphuric acid, to complete the bleaching and to deprive the oil of smell.

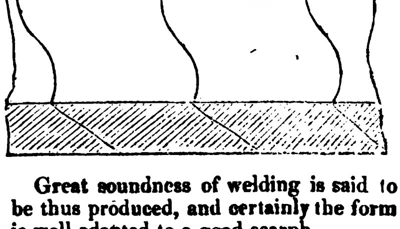
How far these processes would pay in this country, in competition with gas on the one hand and palm oil, &c. on the other, we cannot say, but their efficacy seems to be proved.

Dumas's Chemistry.

Dumas has published, last month, the seventh volume of his Chemistry applied to Arts and Manufactures. This volume, like the two preceding ones, is wholly devoted to organic chemistry, and its applications: it is replete with valuable information to the manufacturer and agriculturist. The chapter on fat, oils, resins and varnishes, contains the most complete body of information upon the recent discoveries in this branch of chemistry that has yet appeared, in which the labours of Liebig and his pupils chiefly, have cleared up many of the obscure questions relative to the changes which these substances undergo when employed as paints and varnishes.

Improvement in Gun Barrels.

A novel manufacture of musket and carbine barrels has commenced in France, to which the government has given some encouragement. Messrs. Renette and Gastine, and M. Albert Bernard, are the inventors, or at least the makers of the new barrels. Those of the former firm, are of iron forged in a new method; they are twisted barrels, made by lapping two triangular bars into intertwined spirals, and welding them together, the vertex of one triangle being inside, and that of the other outside the barrel. Thus, in section.



Great soundness of welding is said to be thus produced, and certainly the form is well adapted to a good scarph.

One of those barrels, proved by M. Leguier, at Vincennes, 71 centimetres long, and weighing 840 grammes, was successively fired with charges of 28, 30, 40, 50 grammes of powder, and 114, 171, 228, 285 grammes of lead; and finally, bore the enormous charge of 60 grammes of powder, and 320 grammes of lead, in No. 4 shot. That is to say, fifteen service charges.

A second barrel of the same size and weight, answered as well, the charges occupying about 43 centimetres of the length of the barrel, or more than half the whole length. The only effects of those enormous proof charges was a slight incurvation produced near the muzzle of one of them.

M. Bernard's barrels are made of cast-steel, of shear-steel (corroyé), that is, welded or wrought steel, and of steel alloyed with $\frac{1}{18}$th of wrought iron; the mode of forging is not stated, but it is to be presumed they are twisted barrels.

A barrel of shear-steel 72 centimetres long, and weighing 832 grammes, after having stood nearly the same succession of charges as before, burst under a proof of 50 grammes of powder, and 300 grammes of lead, added to a depth of six centimetres of earth at the end (we presume the muzzle end) of the barrel.

The cast-steel barrel of the same size, weight 822 grammes, burst after successive proofs, under a charge of 60 grammes of powder, and 360 of lead, which occupied 57 centimetres of its length, or about three-fourths of the whole.

The barrels of same size and weight of the alloy of steel and iron, were ruptured by charges of 40 grammes of powder, and 240 of lead, added to a depth of 12 centimetres of earth, with a void space between.

A double barrel of shear steel, weight 652 grammes, stood without damage a charge of 30 grammes of powder, 180 of lead, and two bullets placed at different intervals in the barrel. These results seem important; the gramme is = 15·438 grains troy.

THE PATENT LAWS—EXTENSION OF THE POWERS OF THE PRIVY COUNCIL.

We extract for the information of our readers, from the Act which has just passed (August 6) for amending the Acts of the 3 and 4 Wm. IV. c. 41, relating to the ad-

ministration of justice in the Privy Council, and the Act of 5 and 6 Wm. IV. c. 83, touching letters patent for inventions, those clauses which relate to the latter branch of the subject.

Clause II. "And whereas it is expedient, for the further encouragement of inventions in the useful Arts, to enable the time of monopoly in patents to be extended in cases in which it can be satisfactorily shown that the expense of the invention hath been greater than the time now limited by law will suffice to reimburse; Be it enacted, that if any person, having obtained a patent for any invention, shall before the expiration thereof present a petition to her Majesty in council, setting forth that he has been unable to obtain a due remuneration for his expense and labour in perfecting such invention, and that an exclusive right of using and vending the same for the further period of seven years, in addition to the term in such patent mentioned, will not suffice for his reimbursement and remuneration, then, if the matter of such petition shall be by her Majesty referred to the judicial committee of the privy council, the said committee shall proceed to consider the same after the manner and in the usual course of its proceedings touching patents, and if the said committee shall be of opinion, and shall so report to her Majesty, that a further period greater than seven years extension of the said patent term ought to be granted to the petitioner, it shall be lawful for her Majesty, if she shall so think fit, to grant an extension thereof for any time not exceeding fourteen years, in like manner and subject to the same rules as the extension for a term not exceeding seven years is now granted under the powers of the said act of the sixth year of the reign of his late Majesty.

Clause III. "Provided always, and be it enacted, that nothing herein contained shall prevent the said judicial committee from reporting that an extension for any period not exceeding seven years should be granted, or prevent her Majesty from granting an extension for such lesser term than the petition shall have prayed.

Clause IV. "And whereas doubts have arisen touching the power given by the said recited act of the sixth year of the reign of his late Majesty in cases where the patentees have wholly or in part assigned their right; Be it enacted, that it shall be lawful for her Majesty, on the report of the judicial committee, to grant such extension as is authorized by the said Act and by this Act, either to an assignee or assignees or to the original patentee or patentees, or to an assignee or assignees and original patentee or patentees conjointly.

Clause V. "And be it enacted, that in case the original patentee or patentees hath or have departed, with his or their whole or any part of his or their interest by assignment to any other person or persons, it shall be lawful for such patentee, together with such assignee or assignees if part only hath been assigned, and for the assignee or assignees if the whole hath been assigned, to enter a disclaimer and memorandum of alteration, under the powers of the said recited Act, and such disclaimer and memorandum of such alteration, having been so entered and filed as in the said recited Act mentioned, shall be valid and effectual in favour of any person or persons in whom the rights under the said letters patent may then be or thereafter become legally vested; and no objection shall be made in any proceeding whatsoever on the ground that the party making such disclaimer or memorandum of such alteration had not sufficient authority in that behalf.

Clause VI. "And be it enacted, that any disclaimer or memorandum of alteration before the passing of this Act, or by virtue of the said recited Act, by such patentee with such assignee or by such assignees as aforesaid, shall be valid and effectual to bind any person or persons in whom the said letters patent might then be or have since become vested; and no objection shall be made in any proceeding whatsoever that the party making such disclaimer or memorandum of alteration had not authority in that behalf.

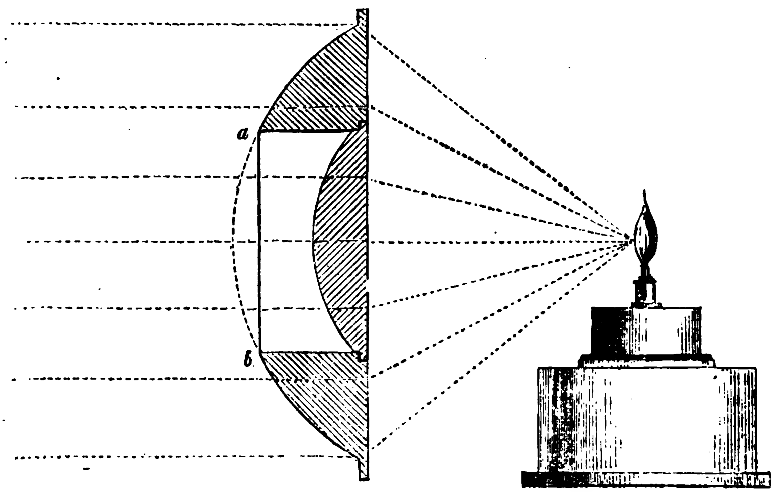
Clause VII. "And be it enacted, that any new letters patent which before the passing of this Act may have been granted, under the provisions of the above recited Act of the sixth year of the reign of his late Majesty, to an assignee or assignees, shall be as valid and effectual as if the said letters patent had been made after the passing of this Act, and the title of any party to such new letters patent shall not be invalidated by reason of the same having been granted to an assignee or assignees: provided always, that nothing herein contained shall give any validity or effect to any letters patent heretofore granted to any assignee or assignees where any action or proceeding in *scire facias* or suit in equity shall have been commenced at any time before the passing of this Act, wherein the validity of such letters patent shall have been or may be questioned."

The first patentee who has given notice of his intention to apply for a renewal for 14 years under Clause II. of this Act, is the Earl of Dundonald—at whose instance, as our readers are aware, that clause was introduced. The patent which he applies to have renewed is that for his Rotary Engine,

which, though so far patronized by the Lords of the Admiralty, that they have authorized his lordship to get it applied at the public expense to H.M.S. *Janus*, nobody else has dreamt of making use of, or probably ever will.

Would it not have been as well, if the Act had provided, that where a person has obtained a patent for an invention, which all the rest of the world think nothing of, and care nothing about, he should be allowed to re-patent it for as long a period as he pleases—say 99 or 999 years? The Privy Council (for an unpaid body) has a great deal to do, and ought not to be troubled with superfluous applications. It might be pleasant hereafter, for posterity to look back on the number of mechanical absurdities and abortions, of which would-be inventors had thus secured to themselves and their heirs, the perpetual honour and monopoly.

POLYZONAL LENS FOR RAILWAY SIGNALS.



Brilliancy and space penetrating power in the light of railway signals is of the highest importance, and equally, or even more so, are the signals for steam-boats, &c.

As the thickness at the centre of the lens of a railway signal lamp depends upon the distance of the lens from the flame of the lamp, in order that the divergent rays may be transmitted parallel, and as this distance is, on account of the limited size of the lamp, small, so the lens, as usually constructed, is very thick, generally from 2 inches to 2½ inches in the centre, and being generally coloured red or some other colour, the loss of light by absorption is very great.

The prefixed figure represents a mode of obviating this, which I have adopted, by an application of the polyzonal lens of Fresnel.

The lens is cast in two parts. The outer, or annular lens, and the inner, or central one, then ground, so as to have a common focus. The inner lens is fitted to the rabbate of the annular one by a little Canada balsam or other suitable cement; and thus the compound lens, at a small additional expense, has less than half the thickness at the centre of the common one, and as short a focal length with much greater penetrative power.

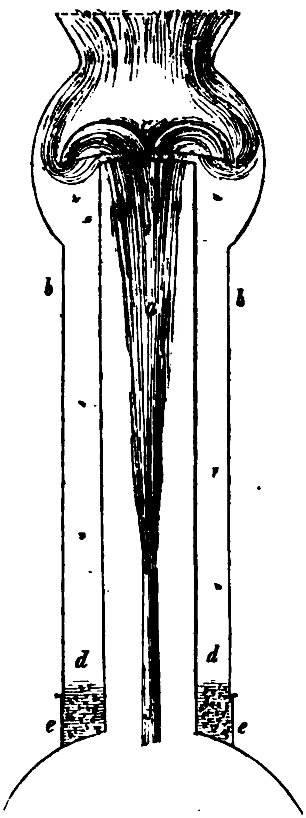
Weight is also saved in the lens, which is of importance in railway signals, when mounted aloft, in stormy weather, and economizes the coloured glass.

The lenses to be completely cleaned, must be washed outside to clear out dust from the sharp re-entering corners of the central lens; but even this might be avoided by fitting and cementing a circular disk of thin plate glass over the central space, from *a* to *b* in section, to keep out dust.

ROBERT MALLET.

Dublin, August 2, 1844.

SPARK-CATCHER FOR LOCOMOTIVE ENGINES.



a is the funnel of a locomotive engine; *b b*, outward casing placed over it; *c*, a deflecting cap (shown in section) placed over the inner funnel, which will give a downward motion to the sparks; *d d*, space between the casing and funnel for receiving the deposit of sparks, which is cleared out when required, at the openings *e e*; *f f*, blast-pipe.

It will be obvious, that this arrangement is free from the detrimental objection of obstructing the blast, as the deflexion takes place at the point where the force of the blast can be softened down sufficiently to allow the sparks to deposit in the casing, without impairing the draft to any perceptible degree in the furnace.

WM. SYMINGTON.

Commercial Road, January 15, 1844.

APPLICATION OF ELECTRICITY TO THE IMPROVEMENT OF THE MANUFACTURE OF IRON.

"The attention of the iron-masters has been attracted to a process of considerable importance lately introduced into their manufacture. The application of electricity, to supersede several of the expensive processes, has, it is stated, been tried in the Welsh and Derbyshire furnaces with satisfactory results. It appears that the costly fuel and labour required for the purification of the ore from sulphur, phosphorus, and such subtle elements, create its high market value; and these being all electro-negative, have induced the new process, whereby the impure stream of metal after flowing from the blast is in its moment of consolidation subjected to a powerful voltaic battery, which so disengages the impure components that in the process of puddling they are readily extracted. The London blacksmiths, it is stated, have tested this iron after a single reheating, and pronounce it equal to the best metal in the market. By the same process an experiment was tried by Dr. Ure, by whom a soft rod of iron was held in contact with a moderate red heat, and that gentleman is understood to have stated that in a few hours the metal was converted into steel. Should these facts prove what they seem, they are calculated to affect most seriously this important branch of our trade."—*Times.—City Article.*

The process referred to in the above extract is that for which Mr. Arthur Wall obtained a patent, November 18, 1843. It is thus described in his Specification, enrolled May 18, 1844:

"In casting a bar or similar mass, the electric current is caused to traverse from end to end, by conductors so arranged, that when the metal runs into the mould it may complete the electric circuit, or by means of a wire or wires, passed from one end of the mould to the other. If the castings are horizontal, a piece of wrought iron or other conducting material is placed at each end of the mould, which is made of sand, or other non-conducting substance: these conductors are then connected by wires with a galvanic apparatus, or voltaic pile, or electro-magnetic or other battery; so that, when the melted iron is run into the mould, it will complete the electric circuit; and the patentee prefers to continue the electric current for some time after the iron has solidified. When the castings are vertical, a similar arrangement is made for the passage of the electric current through the metal, by placing a conductor at the top and bottom of the mould, in such a manner, that the electric circuit will be completed the moment the mould is filled with the liquid iron.

"To apply electricity to iron in a smelting furnace or cupola, a wrought-iron rod is introduced through or at the side of the tap-hole, until it comes in contact with the melting metal, and another wrought-iron rod is introduced at the upper and posterior part of the hearth, or through one of the tuyere holes, until it reaches the metal; the

outer ends of these rods being then connected with a battery, the electric current will be caused to pass through the iron; care being taken not to continue it so long as to entirely decarburate the iron, and bring it to a malleable state. When the electricity is to be applied to the iron in a puddling or balling furnace, two iron rods are also used; one of which is inserted into the fused metal, and the other end is connected with a battery; the other rod is attached to an insulating handle of porcelain, pottery, or other non-conducting substance, and a wire from the battery is connected to it, close to the handle. By means of the handle, the extremity of the rod is caused to traverse the iron in its melted state, or during its transition to the solid state, and the electric current will therefore pass through the metal in every possible direction."

TREATISE ON THE STEAM-ENGINE. BY THE ARTIZAN CLUB.—PART II.

The writer who enacts, in respect of this work, the part of the "Artizan Club," left his readers at the close of Part I. in the expectation of something particularly fine, being forthcoming from his pen, on the genius of Watt. And now we have it.

"To what an exaltation does he not rise by a comparison with Smeaton; certainly next to Watt, the greatest mechanical genius of his time, and one *that* has not been excelled by any *which* has appeared since that epoch. He began his improvements upon the steam-engine about the same time as Watt, and he accomplished all perhaps that could be expected of a patient and technical mind; but the genius of Watt ascended from the narrow circuit of actual experience *into the bright fields of imagination, and drew from thence the inspiration that directed its subsequent achievements.* Smeaton was able to *improve*, but Watt was also able to *create;* and as he had never received any practical training, his mind was free from the fetters of authority, *and the fire of his imagination, unquenched by the chilling dogmas of a sect.* Much of his success is, we think, due to the unsettled condition of his early life, which permitted and demanded a wider range of thought, though its exercise had been restricted to a single occupation; and the condition of an humble citizen was much better adapted for the development of his genius than the ease of academic shades, or the *vanities* of scholastic discipline. Had Watt been born in the atmosphere of Oxford he would have subsided, in all probability, into an expounder of the metres of Pindar; or had his imagination been broken in the schools, he would have sunk, in all likelihood, into a mere professor of engineering. *It is from the race of artizans that genius is chiefly recruited, for the imaginations of the illiterate can at least have fair play, and their spirits are not quelled by the presence of those idols of perfection, before which the learned bow down in admiration. Homer(!) Socrates(!!!) Shakspeare, Burns, Watt, and almost all great original spirits have sprung from the condition of humble life*, and the *splendour of their genius is due in a great measure to that happy accident*, for they had thus no precedent constantly before their eyes within the boundary of which they had to restrain their aspirations, but followed nature without wandering through all her varied aspects; now *conjuring up landscapes of immortal beauty, full of all sights and sounds of sweetness—woodland solitudes and rushing waters—and mountain echoes, and flowers glittering on the moonlight—and now turning to the delineation of the bright or stormy passions of the heart, and raising up spirits of fierce aspect or of matchless grace*, or *analyzing the springs of character, or discussing human duties, or penetrating to the fountain of science;* but *following nature still in all her various mutations, and suffering no idol to interfere between them and that Great Light of which their own glory is the reflection.* Such minds cannot become technical, or be limited in their excursions to one small corner of creation, and the great secret of Watt's greatness as an engineer, is, that he was not an engineer merely."—p. 21.

The wretchedly bad taste of this passage, with its lackadaisical babble about "woodland solitudes," "rushing waters," "mountain echoes," &c.—might be safely left to speak for itself; but there is an amount of wretchedly worse doctrine in it, which may not be so properly passed over in silence. The professed aim of the writer is, to inculcate, that practical training, scholastic discipline, and scholastic learning are unfavourable to the development of the higher powers of mind—that no happier accident can befal a man at the outset of life than to be left to grow wild—that next to the advantage of being poor in purse is being poor in mind, since the more "illiterate" a man is, the greater the certainty of his "imagination" having "fair play"—that

the humbler a person's condition of life, the more the likelihood of his emerging gloriously from it—and that it is only by a constant supply of recruits from "the race of artizans" that the ranks of genius are kept filled. Miserable fallacies, or falsehoods worse than fallacies these,—at variance with all history, all experience, all rational probability. Training—discipline—learning—what is there in them, either as existing in schools and colleges, or elsewhere, that such evil influences as these should be ascribed to them? Are they more to the human mind than tilling, dressing, weeding, watering, and manuring are to the soil? We trow not. When crab-apples are finer than golden pippins, or colewort richer than cauliflower; when good wheat is seen to spring up spontaneously from the common; or when any wild rose can be found to compare with the rose of the garden; then, but not till then, we may admit that all cultivation is vanity. If now and then an uneducated person has achieved for himself a name in letters or in science, we may be quite sure that it has not been by virtue of the want of education, but in absolute spite of it. Never yet was there a man who became great without education, who would not have been greater with it; and but seldom, one so distinguished, who was not himself the foremost to acknowledge that want of education had been a grievous drawback upon his exertions. In truth, it is but in compliance with common parlance that we can say, that men ever do become great, or indeed good for anything, without education; if not educated in early life, they must be educated in after life—to a certain extent and somehow or other—before they can make manifest the power there is in them. Whether the training be early or late—whether it be training by others or self-training—still it is by training only, more or less complete, that a man can overtop the multitude around him. The pillars of our literature and science—from Chaucer to Scott, from Bacon to Dalton—have all been, without a single exception, educated men. If you would know what your "illiterate" people with strong "imaginations" and "fair play," (which means unbridled license) are good for, you must search the domains of superstition and empiricism—enquire after those who have been most famous as astrologers, alchemists, fanatics, false prophets, miracle mongers; seers of signs not to be seen, seekers after treasures not to be found, discoverers of things not to be discovered, workers of wonders not to be wrought, implicit believers in the improbable and impossible. The existing monuments of the benefit they have conferred on mankind, what and where are they? The philosopher's stone, the elixir vitæ, the circle squared, perpetual motion discovered! To assert that it is from "the race of artizans that genius is chiefly recruited," is to assert what is historically and notoriously untrue, from no other motive, we fear, than the contemptible one of pandering to their vanity, for the sake of their applause. A minute's inspection of any biographical collection will suffice to prove to any one the extreme erroneousness of the statement. What are the writer's instances? "Homer," "Socrates," (of all men in the world,) "Shakspeare, Burns, and Watt." Why there is not a genuine artizan, with the exception of Watt, amongst them! Of Watt we shall speak presently; but we may here observe generally of artizans, as a class, that they are unfortunately by far too poor, and too constantly occupied from infancy with providing for their bodily wants, to make it likely, or even possible, that they should produce any considerable number of persons remarkable for intellectual cultivation. Instances there have been of poor men, and artizans too, struggling upwards to literary and scientific renown, notwithstanding all the difficulties and obstacles incidental to humble life; but for one instance of the sort a hundred others might, we fancy, be easily adduced (but that the annals of the poor are so imperfectly kept) of men who possessed the greatest natural genius, but were, solely from lowliness of birth and fortune, never able to rise above their original condition, and died unhonoured and unknown;—

—— "Knowledge to their eyes her ample page,
Rich in the spoils of Time, did ne'er unroll.
*Chill penury repress'd their noble rage,
And froze the genial current of the soul.*"

How much more just the poet's estimate of the effects of penury, than that of the writer under review! "Happy accident," forsooth! Happy any accident which rescues a man from its fangs: but for itself, it is the deadliest enemy humble genius can ever have to encounter.

With respect to Watt—for whose memory we have too often had occasion to express our humble reverence, to make it necessary to disclaim here any intention to disparage his merits—we must say that there have been, perhaps, few men—certainly few artizans—whose history has afforded less sanction to the wild and pernicious notions on which we have been just animadverting. Although Watt had not the benefit of a collegiate or university education, he cannot be considered as having been at any period of his life, or in any sense of the term, an uneducated man; he had a good common school education, was engaged from his boyhood in occupations closely allied to philosophical pursuits, and was in constant intercourse with men of learning and accomplishments. So little, too, had springing aloft "from the narrow circuit of actual experience into the bright regions of imagination," to do with his progress in scientific discovery, that he was, on the contrary, remarkable for never taking a step without experience, or her twin sister, experiment, for his guide; all he did was done slowly, tentatively, deliberatively; and not a single success did he achieve but by dint of the hardest study, and the strictest inductive reasoning. He was reflective, ingenious, sagacious, industrious, patient, persevering; but as little imaginative, or given to flights of imagination, as any man could be. Although, moreover, Watt began life a poor man, it was not long before he met with one of the most generous, munificent, and stedfast of patrons or coadjutors, which humble genius ever had the good luck to possess. He can scarcely be said to have ever known what it was to have his thoughts or labours disturbed by anxiety about the wants of the passing hour; such time and leisure as he required to work out his ideas—and he required, in sooth, a great deal—such pecuniary means, too—he was always, thanks to his fortunate alliance with the princely Boulton, able to command. The friendship of Boulton was "the happy accident" of Watt's life, but for which it is quite within the bounds of probability, he might never have achieved what he did, but have remained for ever "to fortune and to fame unknown."

In the passage we have been remarking upon, the writer but spurts out by the way, as it were, his small spite against education and learning; but that there may be no mistake about the character of his hostility, he addresses the following formal and precious piece of advice to "the artizans of this great empire."

"The same path by which he (Watt) won immortality *is open to them*, and although few may be endowed with the high gifts by which he was distinguished, yet there is no one who, by energy and perseverance, and *by only giving nature fair play*, may not rise to a higher eminence than he had dared to hope for even in his own secret contemplations. One condition, however, of his success is that he must not suffer his mind to become technical; and if an engineer, he must be content to believe that there are other things in the world worthy of his attention besides cast iron and steam pressure. He must not coop up his imagination within the narrow limits of a craft; but *suffer it to roam over creation in its endless fields of beauty; and must cherish a love for nature, and human nature—for rocks, and waterfalls, and mountain solitudes, and soft airs, and sounds, and clear waters, and cloudless skies, and flowers weeping in the moonlight, or smiling through their tears to greet the rising sun.* These, and all the other elements of poetic conception, he must love as a part of his being; *for the rays of beauty that gild these inanimate objects are merely the reflection of his own holiest emotions; and he must hold communion with the spirits of glorious aspect and attractive grace that people the world of fancy*, and survey the enchantments wrought by genius in every field of enterprize, and yield his affection not only to those high virtues which dignify humanity, but to those humble charities that soothe and bless like flowers *scattered upon the desert.* It is only by thus giving full *scope to his imagination, and cultivating* ALL *his capacities*, that his

mind can preserve its just proportions, or grow to any loftiness of stature. * * We find very little of novelty to have originated *among well-educated engineers;* but almost all great innovations have been the work of some less reverential spirit; and whoever aspires to the work of invention must himself go to the fountain of human thought and feeling, and suffer the shadow of no mind to come between him and nature."

If it were desired to know by what process a man of good natural talents might be made good for nothing—might best spend his life in dreaming great things, and end it in a ditch—there could not be a fitter prescription than this—only that some parts of it are not very intelligible, and those which are intelligible are not very practicable. It is easy to say, "the path to immortality is open;" so also is the path across the Desert. It is not always, nor often, that there is a Boulton to furnish the stores requisite for the journey, or a Mehemet Ali to provide guides and guards. Easy, too, to say, "give nature fair play." Nature, when left all to herself, produces weeds as well as flowers. "Eschew the technical," that is to say, the real and the practical, quoth this egregious monitor; study only to be mightily imaginative and gloriously sentimental. Flee far from the noise of the shuttle, and the anvil, and the turning wheel, and woo "*soft* airs and sounds," 'mid "rocks, and waterfalls, and mountain solitudes." And since the streams of your native land are rather "drumly o" —its skies occasionally somewhat "dark and stormy o"—go to some happier clime, where only "*clear* waters and *cloudless* skies" are to be seen, with flowers weeping by moonlight, and smiling at sunrise, &c. Never mind how it may fare in the meanwhile with the pot at home, or even with the wallet by your side. Such vulgar cares as spring out of natural affection and duty, or from the common wants of humanity, are much beneath a man whose "commerce is with the spirits of glorious aspect and attractive grace, that people the world of fancy." You can live as well as they do at any rate, and your care need be for yourself alone. Should you be asked when you return home—to astonish your friends—what have been the fruits of all your roaming—what increase of knowledge and wisdom you have brought with you—it will suffice to say that you have returned a most accomplished—*gilder*. Yes—you will have learnt how to "gild" rocks and stones—how to gild plants and flowers—how to gild water even—yea, to gild "all creation." But how? With Bessemer's patent gold paint, or how else? Oh dear, no! With your "own holiest emotions?" What that may be you must leave them to guess. Perchance the dullards may wish that you had but turned out, in sober earnest, a *good* painter and gilder; be thankful, say we, if they do not lock you up.

Greater harm to the working man—the artizan—no one can do, than to induce in him a belief that eminence is to be only attained by bold flights and happy fancies. It is impossible to imagine any notion more unsettling to the mind, more fatal to stability of purpose, more subversive of habits of application, more destructive of solid improvement, more fraught with disappointment and misery. The truest friend of humble genius is he who tells the truth—the severe but wholesome truth—that the only sure path to fame is industry—hard persevering industry—and the best friend to industry, a knowledge of what has been said and done by others before us. Johnson has well observed, that "he who wishes to be counted among the benefactors of posterity, must add by his own toil to the acquisitions of his ancestors;" to which we may add that, unless a man know what the acquisitions of his ancestors have been, and be thereby able to avoid producing the same things twice over, he may have much toiling to no purpose. The prodigious quantity of misdirected and misapplied labour which arises every day from sheer ignorance of what has been already accomplished, is painful to think on; and to no class of men does a larger share constantly fall than to your "illiterate" men of fine imaginations, who stand gaping at waterfalls, and go a-hunting after mountain echoes. If men will but read and study hard—inform, exercise, and invigorate their minds (which is what Watt

really did)—they need be in no fear about the crop that is to come after. Richer fruits will to a certainty come of such training than of any other. Neither all nor many can hope to reach to eminence (for to speak of eminence, far less "immortality," as being commonly attainable, under any possible state of things, is gross delusion); but there will be fewer starving, and whining, and blubbering, and perishing by the way. The more you know, the more you are capable of performing; and all experience shows that a man's chances of attaining to competence or independence, are ever exactly proportional to the services he can render to others. Many a meritorious person may miss the patronage of which he is in need, but he will, at least, not have to reproach himself with having failed to do his best to deserve it; and should fortune prove permanently unkind, he will find that knowledge has consolations even to the poorest, which are to be derived from no other source whatever.

It has been for a long time the fashion with writers on the steam-engine, to treat it as having come out of the hands of Watt, so perfect a thing, that there was nothing left for subsequent strivers at improvement to do, and that, in fact, they have done nothing. On this point the present writer thinks it well to go with the stream. "If the field in which Watt laboured be *exhausted*—if his ingenuity has made further improvement upon the present steam-engine in any material point *hopeless*, so long as fire remains the impelling power," &c. We must confess that there seems to us to be something very like cant in all this. When we reflect on the vast progress, which steam navigation and railroad locomotion have made since the days of Watt, both of which are applications of steam power hardly thought of by him, and on the numerous and important modifications of the engine which have been found necessary in order to adapt it to these new purposes—when we think of the great reductions which have been effected in very recent times in the weight of steam-engine machinery, in the space occupied by it, and in the fuel consumed by it—when we see present to our eyes, every day, engines differing materially in construction from any proposed by Watt—the oscillating and direct-action engines for example—and suiting the particular purposes to which they are applied, *better*—it seems to us strangely at variance with truth to say, that improvement in this branch of mechanical science had reached its limits when Watt departed from the scene. The practice of the great Soho itself is not what it was in the days of its Founder. The beam-engine is no longer sole idol there. And this single fact alone—were there no other which could be adduced—ought of itself to be a decisive refutation of the perfectability theory.

The other contents of this Part call for but little notice. The most observable thing about them is the number of "old familiar faces," and the extreme want of methodical arrangement. The writer appears to have huddled the things into his pages as they came to hand, from some heap of clippings, *pro hac vice*, without the least regard to order of dates or sequency of subjects; and for lack of something better to fill up his last page with, he concludes with a clipping from Templeton (or some other Engineer's Vade-Mecum) of that extraordinary rarity, a Table of the areas of circles! We presume it is intended to give next the Multiplication Table.

SUBMARINE PERCUSSION SHELLS—CAPTAIN NORTON IN REPLY TO MR. MALLET.

Sir,—Having this day read in your Magazine, of the 10th instant, a letter from Mr. Robert Mallet of Dublin, stating that the submarine percussion shell that I constructed about four years ago is identical with a percussion shell which he showed and explained to me in Dublin, in 1832, I beg in answer to say that, I perfectly remember his showing me a grenade or shell, having a piece of stick about a yard long fixed into it, and at the upper end pieces of card or pasteboard to cause it to fall like an arrow, and that he let this shell fall two or three times from the second story of a large unfinished building on the banks of the canal near Dublin, and that the shell exploded on the second or third fall. Mr. Mallet did not explain to me the interior contrivance, nor am I aware that I asked

him. The object of this shell, I understood to be, for the protection of houses against hostile attack, and the contrivance of the arrow, being what I had already tried many years before I had the pleasure of being introduced to him, did not appear to me to be a novelty. I have not yet seen the "*Civil Engineer's Journal*" for this month; but I did see in the *Illustrated London News*, after a full description of Captain Warner's experiment off Brighton, an erroneous statement that the submarine percussion shell, which I had contrived as a possible means for ascertaining the depth of the deep sea, had been applied to field artillery, and pronounced to be "simple, safe, and efficacious". I wrote a note to the Editor, pointing out the error, not knowing from whom it was derived, which note appears in the *Illustrated London News* of the 3rd inst., and which will answer Mr. Mallet's question. As to the engraving of his percussion shell in your Magazine of the 10th inst., if it is calculated for the purpose of exploding by concussion on reaching the bottom of the sea, all I can say is, that I was not aware of it. A model of my submarine percussion shell intended for that purpose is to be seen in the Polytechnic Gallery, and that model will better speak for itself than any description I can give.

JOHN NORTON.

August 14, 1844.

APPLICATION OF THE ELECTRO-MAGNETIC TELEGRAPH TO THE DETERMINATION OF THE LONGITUDE.

[From the American papers.]

Among the many wonderful developments of the new telegraph one has just come to light which will be regarded in the world of science as deeply interesting. Professor Morse suggested to the distinguished Arago, in 1839, that the electro-magnetic telegraph would be the means of determining the *difference of longitude* between places with an accuracy hitherto unattainable. By the following letter from Captain Charles Wilkes to Professor Morse, it will be perceived that the first experiment of the kind of which we have any knowledge, has resulted in the fulfilment of the Professor's prediction:—

Washington, June 13, 1844.

My dear Sir,—The interesting experiments for obtaining the difference of longitude through your magnetic telegraph were finished yesterday, and have proved very satisfactory. They resulted in placing the Battle Monument square, Baltimore, 1 m. 34 sec. ·868 east of the Capitol.

The time of the two places was carefully obtained by transit observations. The comparisons were made through chronometers, and without any difficulty. They were had in three days, and their accuracy proved in the intervals marked and recorded at both places. I have adopted the results of the last day's observations and comparisons, from the elapsed time having been less.

The difference of the former results found in the American Almanac is ·732 of a second. After these experiments I am well satisfied that your telegraph offers the means for determining *meridian distances* more accurately than was before within the power of instruments and observers.

Accept my thanks, and those of Lieutenant Eld, for yourself and Mr. Vail, for your kindness and attention in affording us the facilities to obtain these results.

With great respect and esteem, your friend,

CHARLES WILKES.

Prof. S. F. B. Morse, Capitol,
Washington.

COLLEGE OF CHEMISTRY.

We have before us a "Proposal for establishing a College of Chemistry for promoting the Science and its application to Agriculture, Arts, Manufactures, and Medicine." It is headed by a long list of distinguished persons who have enrolled themselves as patrons of the projected establishment; but of much greater weight with the public than mere names, should be the reasons urged in favour of it, which are of a very sensible and judicious character. We subjoin so much of the prospectus as relates more immediately to the advantages likely to be conferred by the proposed school on agriculture, arts, and manufactures, and heartily wish it every possible success.

"The especial claims of a Practical School of Chemistry to the support of all classes of persons, may be illustrated by a reference to some of the effects already produced upon commerce by pure scientific discoveries, as well as to the splendid anticipations we are warranted in entertaining for the future.

"In a work recently published in this country by Professor Liebig, 'Familiar Letters on Chemistry, and its relation to Commerce, Physiology, and Agriculture,' the author has traced the dependance of the manufactures of glass, soap, sulphuric acid, and gunpowder, together with the arts of refining, calico-printing and bleaching, as at present practised, to one discovery of science, namely, a method of obtaining soda from common culinary salt; and he shows, that 'But for this new bleaching process, it would scarcely have been possible for the cotton manufacture of Great Britain to have attained its present enormous extent—it could not have competed in price with France and Germany.'

"Every one will remember the dispute between Great Britain and the government of Naples respecting the monopoly of sulphur. This arose from the necessity of a supply of sulphuric acid for innumerable purposes in this country, in the arts and manufactures. The export of sulphur is a great source of riches to Naples; it constitutes the chief value of Sicily. We have, in fact, in this country, mountains of sulphur and sulphuric acid, in a state of combination with iron, lead, barytes, lime, or other substances, from which sulphuric acid can be produced, but at present, not quite so economically as from imported sulphur: ere long the scientific chemist will point out a means of accomplishing a separation of the sulphur, which will render us independent of a foreign supply.

"Another article of commerce, phosphorus, comparatively unimportant, is yet used to the extent of 200,000 pounds annually, in the metropolis alone, in the manufacture of matches, lucifers, and chemical purposes. This is all imported, although we have abundant sources whence it might be derived in this country.

"But our expectations of future applications of Chemistry to the benefit of society are more especially based upon the fact, that a key has been furnished us to unlock the mysteries of organised beings, enabling us to discover the elements of which plants and animals are composed, the manner in which those elements are combined with each other to build up their structures, and the sources whence they are derived. We are now able to analyse any organic substance, whether animal or vegetable, and to find the proportion of every kind of matter it contains, with the same accuracy as we can make out the composition of a mineral. It is understood that Professor Liebig is engaged in ascertaining the exact amount of the elementary constituents of, and the mode of their combinations in all kinds of food. Thus we shall learn, for example, what are the elements of wheat, and in what respect it differs from barley, oats, or other grain; the state in which those elements must exist in the soil to enter into the growing crops and to render a field fertile. The immediate practical consequence of this knowledge will be, that an analysis of the soil of a field with the exactness now attainable will inform us for what particular crop it is adapted, what element it may need, and what we must supply as manure, in order to render it fertile.

"Experimental farming is proverbially a certain road to loss and ruin. What incalculable wealth has been expended in attempts to ameliorate the soil, by blindly heaping it with manures, or dressing it with the most inappropriate substances, simply because the experimentalist has known neither what the land contained, nor what the plant he was desirous to grow needed for its nourishment. Such losses will infallibly be prevented as the science of chemistry advances and its application to agriculture is extended.

"A broad foundation for this application was long since laid by Sir Humphry Davy, in his 'Elements of Agricultural Chemistry;' and since the analysis of organic bodies has by successive improvements become precise, it cannot be doubted that the issue will sooner or later be a great change in the practice of farming from chemical principles.

"We have alluded to the inexhaustible store of sulphuric acid laid up in our hills. The wealth to be derived from the separation of that acid, represents but a feeble per centage of that which will flow from our soil, could means be discovered to render the materials, existing in it available to plants, and capable of becoming their nourishment. Liebig has shown that some of those soils which are reckoned the most sterile, contain all the essential elements for producing most abundant crops, could a cheap means of changing the *state* of those elements be discovered.

* * * *

"This Institution is intended to embrace,

"1st. 'A Laboratory' (as designed by Sir H. Davy) 'for original investigations, and for extending the boundaries of this most important national science, on the model of the Giessen Laboratory.

"2nd. 'A College' for the instruction of students in analysis and scientific research, upon such terms as to encourage young men of talent and scientific taste to apply themselves to Chemistry, and for qualifying public lecturers and teachers.

"3rd. Departments for the application of Chemistry to especial purposes, as Agriculture, Geology, and Mineralogy, by the analysis of soils, rocks, &c.; to Medicine, Physiology, and the Arts.

"4th. The employment of such means as may appear expedient to the Council for encouraging and facilitating the pursuit of Scientific Chemistry throughout the country, and for making it a branch of general education.

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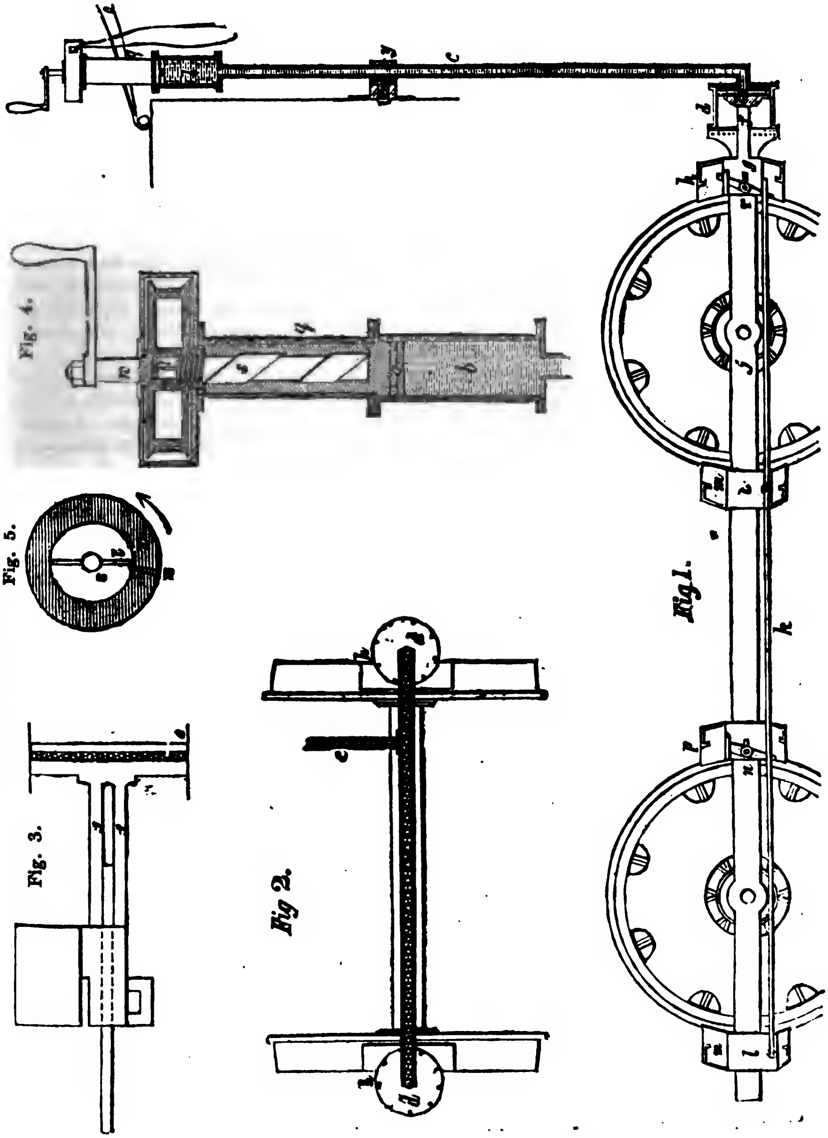
LIPSCOMBE'S PATENT HYDROSTATIC BREAK.



LIPSCOMBE'S PATENT HYDROSTATIC BREAK.

[Patentee, Frederick Lipscombe, of University-street, Gent. Patent dated August 16, 1843; Enrolled February 16, 1844.]

NUMEROUS and varied as have been the breaks introduced to public notice, there is still a general feeling among those connected with railways that there is not a perfect one amongst them. Who, when riding in a break carriage, can doubt this? Every one is aware that there is a most disagreeable jolting of the carriage, accompanied frequently with a loud screeching noise every time a break is brought into action. These annoyances may be very easily avoided, and are only occasioned by using breaks constructed upon a bad principle. Let any one attentively observe those in use. With most of them he will detect a great misdirection of power from obliquity of action, and he will observe that all those breaks put into operation by a guard seated on the top of, or inside a carriage are invariably, and from their principle of construction must necessarily be, fixed to the body of the carriage. It will be seen in an instant, that when the blocks of such breaks are forced against the wheels, the carriage springs cannot act; the effect of passengers riding in the carriage is precisely the same as if the carriage were without springs and forced to slide along the rails. There are many other objections to the breaks in use. The most efficient are those of great mechanical power, but these are very slowly put into action, and in case of sudden danger would be of little avail, as a train may rush into danger even before such breaks can be brought into action. It is true, there are some requiring only four or five turns of a winch to get them into operation; but on the other hand, they require immense manual strength to lock the carriage wheels. It has, moreover, been frequently remarked, that a couple of guards, each having the control of only one break, however good, are insufficient to stop a long train quickly, in case of sudden danger, even with the simultaneous exertions of the engine-driver and fireman. It sometimes happens at night, and even during the day, that neither engine-driver, nor fireman, nor guards are aware of danger existing until within 100 or 150 yards from the object of apprehension; but at present, a train of from 10 to 20 carriages cannot be brought to a standstill when going at full speed, within anything like either of those distances, especially when the rails are wet. Nearly every accident which has occurred upon railways from accidental obstructions might have been avoided, could the trains have been stopped within a moderate distance.

The distinguishing feature of the hydrostatic breaks is, that *two* of them may be *separately* put into operation *by one guard*, and the wheels of two carriages locked in less time and with less exertion than one of the existing breaks would require; moreover, permitting an unrestrained movement to the carriage springs at all times.

By referring to figs. 1, 2, and 4, it will be seen that this apparatus is put into action by forcing the plunger *a* against the water or other liquid contained in the cylinder *b*, the tube *c*, and the cylinder *d*, thereby driving the piston *e* towards the wheels; fixed to the piston is the rod *f* (see figs. 1 and 3), having at its other end the guide *g*, which slides upon the connecting-bar *j*; to the guide is firmly secured the block *h*. The guide *g*, upon being forced towards the wheel causes the upper end of the lever *r* (this lever turns upon a stud fixed to the connecting-bar *j*,) to move in the same direction; consequently, the other end of the lever moves away from the wheel, dragging with it the rod *k*, to which is fixed the two guides *l*, to which are firmly secured the blocks *m*; the rod at the same time pulls the lower end of the lever *n*, (which turns upon a fixed stud the same as the lever *r*,) thereby forcing the block *p* against the wheel. It will readily be seen that the whole of the blocks move simultaneously.

To prevent a possibility of the liquid escaping past either the plunger *a*, or piston *e*, when under pressure, they are each formed of two metallic plates fitting air-tight in the usual way; these plates are kept asunder about half an inch, the space between them being filled with a liquid of great consistency. The denser

liquid will, of course, always sustain the same pressure as the lighter liquid, and it thus forms a packing of the very best description, by rendering it impossible for the lighter liquid to ooze past the advanced plate of either plunger or piston. The pressure of the atmosphere will always prevent a vacuum being formed between the metallic plates.

To withdraw the blocks from the wheels, it is merely necessary to raise the plunger *a*. The atmosphere, in order to prevent a vacuum being formed between the plunger and the liquid, will compel each piston in the cylinder *d* to drive the water up into the tube and there keep it suspended. This reversing motion of the pistons, causes the blocks to recede from the wheels.

It will be observed, that no part of the apparatus is fixed to the body of the carriage; that part situated at the back of the carriage is merely supported laterally by the revolving guide *s*, through which it freely plays; this apparatus can never therefore influence, in the slightest degree, the movement of the carriage springs. It remains now to explain in what manner *two* hydrostatic breaks are easily and quickly brought *separately* into action *by one guard.*

In ordinary breaks the same mechanical power which advances the blocks *to*, forces them *against* the wheels; it is manifest that speed is chiefly required in the former operation, and great mechanical power in the latter. It is obvious, therefore, that were we to obtain speed in the first operation by using a combination of mechanical forces chiefly adapted for speed, and then, by instantaneously changing that combination of mechanical forces to a combination possessing great mechanical power, we might, with two rapid turns of a winch, lock the carriage wheels with but little effort. A great deal of time and labour are wasted by turning a winch with the hand many times, when, by using extra force, one turn would suffice. For example, a man would take less time in overcoming a resisting body by turning a winch once, and exerting a force of 10 lbs., than if he turned the winch ten times employing a constant manual force of only 1 lb., or by giving the winch 120 turns, and only exerting a permanent manual force equal to 1 oz.: this is a fact very well known to mechanicians.

The method of altering the combination of mechanical forces is very simple, and is thus explained:

By referring to fig. 4, it will be observed, that the head of the plunger *a* is round, and slides in the cylinder *b*, but the prolonged part of the plunger is square, and slides in the case *q*; this prolongation is tapped to receive the screw *s*, which has two kinds of threads, one being very coarse and adapted for speed, working in the prolonged part of the plunger; the other kind being very fine, and adapted chiefly for the obtainment of great mechanical power: these fine threads are situated at the upper part of the screw, and work in the winch *w*, which is tapped to receive them; the screw *s*, may therefore be designated a loose screw; at the upper extremity of this screw is fixed a pin, to which is secured the steel-bar *t*, a portion of the winch being bored to receive it, as is seen in fig. 4.

By referring to the enlarged section, fig. 5, it will be seen, that by turning the winch *w* in the direction of the arrow, the projection *x* will be forced against the steel-bar *t*, which will turn the screw *s*, and so drive down the plunger at every revolution of the winch a distance equal to the space between the coarse threads of the loose screw *s*; but immediately the blocks are forced against the wheels, the loose screw, from the resistance of the wheels, becomes unable to turn the manual force exerted at the extremity of the winch, and is then expended in deflecting the spring *t*, so as to permit the projection *x* to pass it; the winch internal screw now acts upon the fine threads of the loose screw, driving that screw with the plunger perpendicularly downward with great force; two turns of the winch will lock the wheels.

The hand may be taken from the winch at any time, as the fine threads of the winch internal screw will counteract the tendency of the loose screw to be turned by the plunger.

Immediately a guard has put the break of his own carriage into action, he seizes the strap *o*, which is coiled round the winch drum of the contiguous carriage, and by pulling towards him one side of that strap, turns the winch of the break apparatus of that carriage and quickly locks its wheels; he withdraws the blocks

from the wheels by simply pulling towards him the *other side* of the strap, which reverses the motion of the winch.

The guard is assisted in forcing the blocks against the wheels in two ways. First, by the weight of liquid between the plunger *a* and cylinder *d*; supposing the distance between them to be 7 vertical feet, that will give a pressure of about 3½ lbs. to the square inch; should the area of the two pistons in the cylinders *d* contain 100 square inches, there will be 350 lbs. ever ready, by a slight touch of the winch, to carry the blocks to the wheels. Secondly, the tendency of 7 vertical feet of suspended water to create a vacuum between it and the plunger *a*, is about 3½ lbs. for every square inch of the plunger's area; should this contain 7 square inches, then this downward tendency of the water would be equal to 24½ lbs.; indeed this downward tendency of the water, without the assistance of any manual force, would, of itself, drag down the plunger and cause the blocks to be forced against the wheels, but for the fineness of the winch internal threads which overpowers that tendency.

It has been seen how easily and quickly the apparatus may be put into efficient operation; the calculation will now be entered into of the manual force required to reverse the apparatus. It has before been said, that to effect this, it is merely necessary to raise the plunger *a*; the downward tendency of the water alone resists the upward movement of the plunger. This resisting force, even were the threads upon the loose screw of the very coarsest kind, could not be more than 24½ lbs.; a manual force therefore of 2 or 3 lbs. at the utmost, at the end of a winch, would be sufficient to raise the plunger.

The chief advantages of the hydrostatic break, are—

1*st*, *The ease and rapidity with which a guard could separately lock the wheels of two carriages.*

2*nd*, *The carriage springs are at all times left unrestrained in their movements.*

N.

NEW WOOD PAVING.

[Registered under the Act for the Protection of Articles of Utility. Henry Tilley, of Piccadilly, Proprietor.]

After the fifty and more patents which have been taken out for wood paving, it might have been thought that every possible variety of form that could be hit upon, had been appropriated by one or other of the patentees. At the Polytechnic Institution—that great emporium of novelties—there is to be seen, however, a model of a plan of paving lately invented by Mr. Tilley, which appears to be different from any that has been yet proposed. The engravings on the opposite page will make the construction of it sufficiently clear to those who have not an opportunity of personally inspecting it. Dr. Ryan, the learned and popular Professor of the Polytechnic Institution, pronounces it to be, in his judgment, the best that has yet been produced; and it is by his recommendation the inventor has been induced to protect it by registration.

Figure 1 is a top plan of one compartment of wood paving constructed on this system, and fig. 2, a section on the line *a a*.

A A A A, are four separate blocks of a triangular form, which are cut away at the sides in the manner shown at *b b*, so that when a number of these blocks are placed side by side with the larger ends uppermost, there are grooves, or intervals, B B, left between them on the top surface, and empty triangular spaces, C C, beneath. D is a connecting or dovetail piece, shown separately in fig. 3, by which each pair of blocks is connected endwise with the pair opposite to it; and a groove, or interval, is also formed on the top surface between the pairs of blocks in a direction opposite to that of the grooves, B.

The advantages of paving thus formed are, that presenting a regular alternation of raised and sunken parts, it will afford good footing for horses, while the vacant spaces beneath, will allow a free passage for air, wind, and water.

Fig. 1.

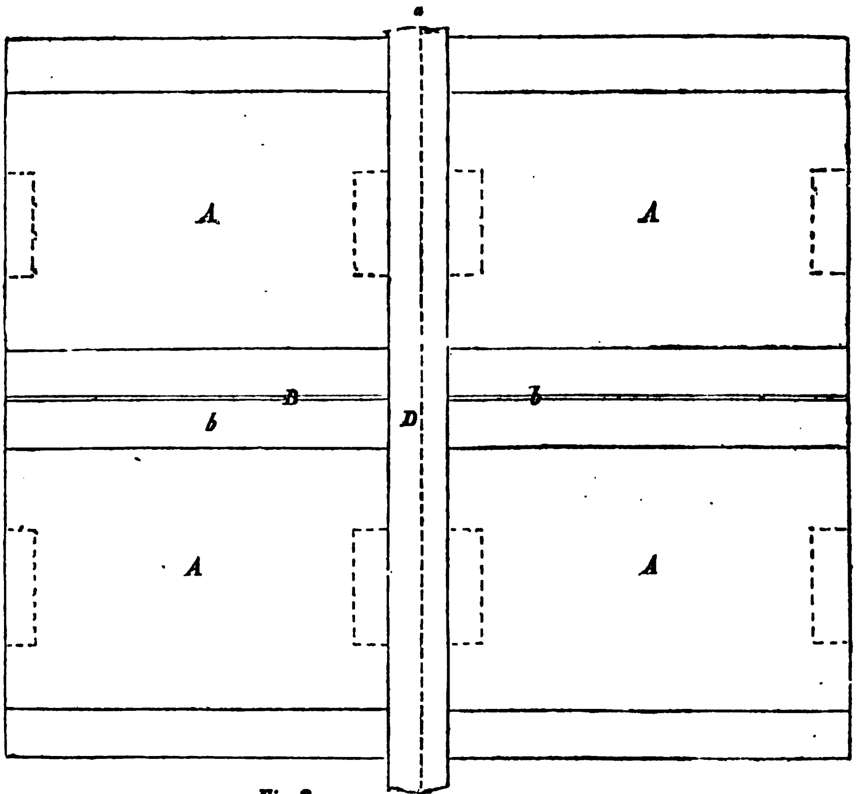


Fig 2.

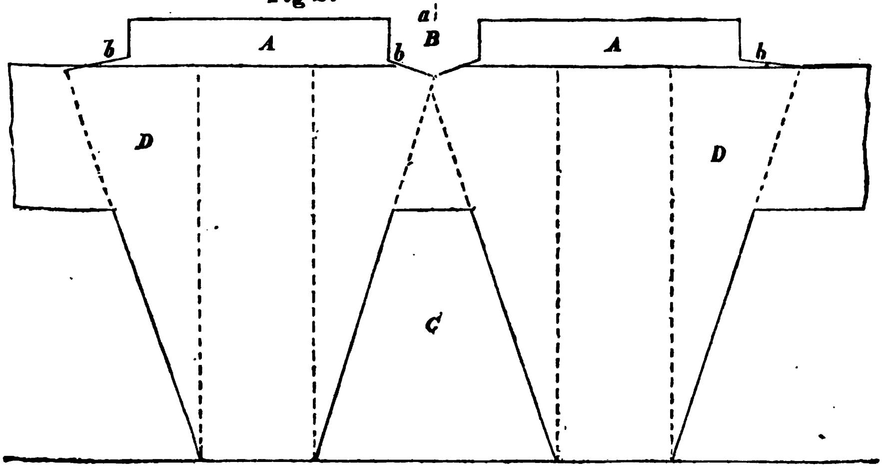
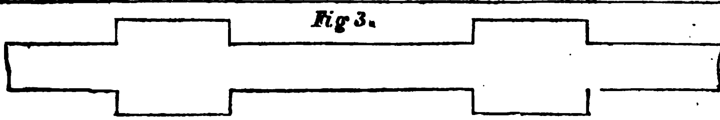


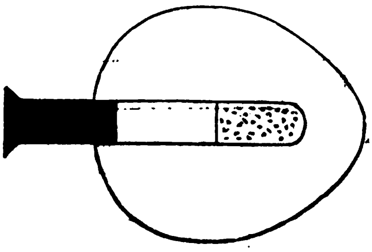
Fig 3.



BOMB-SHELL WITHOUT A FUSE—A THIRD CLAIMANT.

Sir,—In your very useful and edifying Magazine of the 10th of this month, page 87, is a long-wished-for description of Captain Norton's percussion shell; and in the next page I find a call on the Captain to show cause why the priority of discovery should not belong to Mr. Mallet, of Dublin. I now make call on both to show cause why the discovery should not be assigned to myself, the credibility of my witnesses being unimpeachable, circumstances and dates being received in evidence. However the aforesaid belligerents may come off between themselves, I lay claim to the bone, picked and nibbled as it has been ever since its first appearance; yes, and prior to its being published in the *Mechanics' Magazine*, in November, of the year 1823, page 217.

In December, 1812, I presented to the Master-General of the Ordnance the following plan, with the figure, of a bomb-shell which would explode without a fuse, and which, by his direction, was submitted to the Committee of Officers at Woolwich Warren.



The shell was designed to be pear-shaped. It included a chamber, the lowest part of which received the powder, the upper a plug or piston projecting outwards; and between these rested a proportionate quantity of air. The heaviest, or plug end, ensured the direction; so that when the shell had been fired against a fort, ship, or other resisting object, the air-tight plug would be forced into the shell, which, from compressing the included air, the powder must become ignited,—as by the "French soldiers' air-tight cartridge,"—and the shell be exploded.

The committee of Royal Artillery officers condemned the shell, as did the Chancellor of Great Britain, Vansittart, the application of steam in the navy. In their Report, dated 15th January, 1813, signed by General Farrington, they say, "The shell not being spherical, and liable to be exploded *within the mortar*."

A shell similar to this has been since proved most efficaciously by Colonel Millar, of the Royal Artillery, at Fort Leith. The account says, "it will perforate three ships' sides." The Colonel's shell is cylindrical, which is *less spherical* than mine, and rifle-grooved on the outside. But the chamber, piston, and fireless construction, with the mode of exploding, are precisely the same as those of my proposal to the Royal Artillery officers at Woolwich; nor do I see any difference in these respects in any subsequent formation, or intended *direction* of the shell; none certainly as simple, or for the better.

By this publication I do not mean to impugn the originality of others on the same subject of invention. I have devised, like others, without knowing what had been done, and have seen my own ideas usefully and profitably realized by those who knew nothing of mine. But I contend for claiming a *caveat*, against the whole reward of the British Government being bestowed, wholly on any one of us competitors, for the national reward so justly due to the original inventor of an imperial safeguard. And of this I am convinced, *from good experience*, that when the liberal Government shall issue its cheque on the *Potosi* of Threadneedle-street (for, perhaps, something less than the great Warner demands), the parties, *originators* of the invincible fuseless bomb-shell, which is to prevent England being taken by the French, will not forget the bombardier of 1812.

T. H. PASLEY.

Jersey, August 15, 1844.

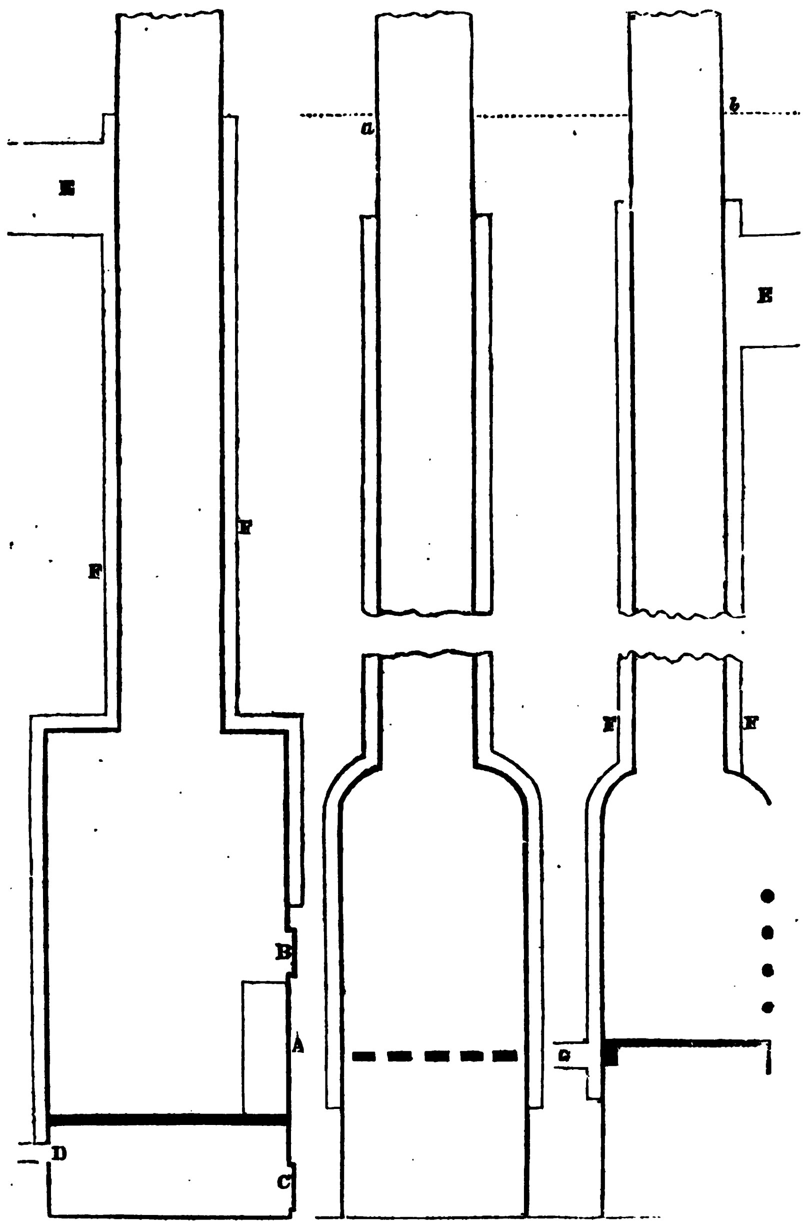
THE ICE TRADE.

We quote from the *Liverpool Standard* the following interesting account of the ice trade of the United States. We may observe, however, by the way, that since the recent English invention of Masters, (see *Mech. Mag.*, No. 1070,) by which ice can be manufactured *impromptu*, of as good a quality as any natural ice, and obtained at much less cost, it is a branch of trade which

cannot be expected to flourish much longer. Masters's machine is now getting rapidly into use in our Club Houses and Hotels; and one has been just ordered for Tortoni's, in Paris, which is to manufacture sixteen different varieties of ice cream, within ten minutes after they are ordered.

"As we are henceforth to have this cooling luxury regularly supplied to us, and its great superiority, both in clearness and thickness, over the home article (owing to the precarious nature of our winters and other causes) is acknowledged by all who have tried it, a short notice of its uses, the manner of keeping it, and of cutting and securing it in America, may prove interesting. Ice has become a great article of export in America. Sixty thousand tons are annually sent from Boston to southern parts, the East and West Indies, &c.; and as sawdust is solely used in packing, a large trade is also carried on in that article. The ice-houses, near the lakes and ponds, are immense wooden buildings, capable of holding 10,000 to 20,000 tons each; some of them, indeed, cover half an acre of ground. They are built with double walls,—that is, with an inner wall all round, two feet from the outer one; and the space between is filled with saw-dust,—a non-conductor—making a solid wall, impervious to heat and air, and of 10 feet in thickness. The machines employed for cutting the ice are very beautiful, and the work is done by men and horses, in the following manner:—The ice that is intended to be cut is kept clear of snow; as soon as it is sufficiently thick to bear the weight of the men and horses to be employed, which it will do at six inches; and the snow is kept scraped from it until it is thick enough to cut. A piece of ice is cleared of two acres in extent, which, at a foot thick, will give about 2,000 tons. By keeping the snow off it freezes thicker, as the frost is freely allowed to penetrate. When the time of cutting arrives, the men commence upon one of these pieces, by getting a straight line through the centre each way. A small hand-plough is pushed along the line, until the groove is about a quarter of an inch in width, and three inches deep, when they commence with the 'marker'—an implement drawn by two horses,—which makes two new grooves parallel with the first, 21 inches, the gauge remaining in the first groove. It is then shifted to the outside groove, and makes two more. The same operation goes on, in parallel rectangular lines, until the ice is all marked out, into squares of 21 inches. In the meanwhile, the plough is following in these grooves, drawn by a single horse, a man leading it; and he cuts up the ice to a depth of six inches. The outer blocks are then sawn out, and iron bars are used in splitting them. These bars are like a spade, of a wedge form. In dropping them into the grooves the ice splits off, and a very slight blow is sufficient to separate them; and they split easy or hard, according to the weather in a very cold day. Ice is very brittle in keen frost; in comparatively softer weather, it is more ductile and resistible. Platforms, or low tables, are placed near the opening made in the ice, with an iron slide reaching from them into the water; and a man stands on each side with an ice-hook, very much like a boat-hook, but made of steel, with fine sharp points. With these the ice is hooked with a jerk that throws it on the platform on the sides, which are of the same height. On a cold day everything becomes covered with ice, and the blocks are each sent spinning along, although they weigh two cwt., as if they weighed only a pound. The slides are large lattice-work platforms to allow the ice to drain, and three tons can thus be easily run in one of them by one horse. It is then carried to the ice-houses, discharged upon a platform in front of the doors, and hoisted into the building by a horse. Forty men and twelve horses will cut and stow away 400 tons a day. If the weather be favourable, 100 men are sometimes employed at once; and in three weeks the ice-crop, about 200,000 tons, is secured. Some winters it is very difficult to secure it, as a rain or thaw may come that will destroy the labour of weeks, and render the ice unfit for market; and then it may snow and rain upon that, before those employed have time to clear it off: and if the latter freezes, the result is *snow-ice*, which is of no value, and has to be planed off. The operation of planing proceeds in nearly the same manner as that of cutting. A plane gauged to run in the grooves made by the 'marker,' and which will shave the ice to a depth of three inches at one cut, is drawn by a horse, until the whole piece is regularly planed over. The chips are then scraped off. If the ice is not then clear, the work is continued until the pure ice is reached, and a few nights of hard frost will make it as thick below—inch for inch—for what has been taken off above. The ice is transported on railways. Each ice-house has a branch railway from the main line; and is conveyed in properly constructed box-wagons to Boston—a distance of (as the locality may be) 10 to 18 miles. The tools, machinery, &c., employed, and the building the houses, and constructing and keeping up the railroads, &c., are very expensive; yet the facilities are such, through good management, that ice can be furnished at a very trifling cost per pound; and a failure of the ice-crop in America would be a great calamity."

Fig. 3. Fig. 1. Fig. 2.



Sir,—I beg to transmit for insertion in your widely circulated Magazine the accompanying sketches of apparatus or stoves for warming and ventilating apartments, and which will be found admirably adapted to offices, and other rooms where

a number of individuals are daily assembled.

Assuming the amount of air that passes over the fire of an ordinary or register stove to be five times the quantity of that which passes through the fire, for every pound of coal consumed, 1000 cubic feet of air must ascend the chimney; and as an ordinary fire will consume about 5 lbs. of coal per hour, at least 5000 feet of air must pass through the room in that time. We have, therefore, no difficulty whatever, in accounting for the dreadful draughts experienced in cold weather, by which one side of the body is frozen, whilst the other is being roasted, and which induce the highly injurious, but very prevalent custom of standing with the back to the fire, and the ridiculous attempts that are made by listing doors, pasting up windows, &c., to keep out that which, if the fire is to burn, must find its way into the room. What renders the matter still worse is, that with all this inconvenience, a greater evil still is experienced from the imperfect ventilation afforded. To rectify this latter evil ventilators are introduced; but these, instead of accomplishing the object they are intended for, have no other effect than that of admitting a constant supply of cold air, and generally prove so great a nuisance to those who are subject to their immediate influence, that they are in most cases a constant source of trouble, and are alternately opened and closed at the caprice of the several inmates.

Close stoves, or such as are mostly used in cold climates, do not cause such drafts as the open fires do; but then the far greater evils they entail from imperfect ventilation, render them unbearable in this country, and they are, therefore, mostly confined to stores, or such other places as require merely being kept dry.

I need scarcely observe, that simple as my invention may appear, it has been consummated only at the expense of much labour and reflection; but connected as I conceive the subject of ventilation to be with that of combustion, the theories of artificial light and of rain, the decomposition of organic matter, respiration, and the properties of carbonic acid, (some of which I conceive have escaped notice in analysing for the presence of that gas,) it is not my intention now to enter upon a philosophical consideration of the subject, but to leave that for future discussion, when I think I shall have no difficulty in showing that the present prevailing notions are based upon erroneous data. I shall, therefore, describe as briefly as possible what I conceive to be more immediately the mechanical bearing of the subject.

I propose placing in the present chimneys or fire-places an open stove something like the Franklin stove (see fig. 2), with a pipe sufficiently long to reach above the ceiling of the room (*a*, *b*). To the back and sides of this stove, and all round the pipe, I place a casing of sheet iron or brass (F F) to be made air-tight to the bottom of the stove, and air-tight with the funnel at or about the level of the ceiling. To the bottom of this casing I attach a pipe (G) that shall communicate with the open air, and at the top of it within a few inches of the ceiling I have an aperture (E) that shall allow the air freely to escape into the room.

It is evident that immediately the stove and its funnel become heated, and the air is being drawn off from the room, the air between them and the casing will also become warm, and as heated air has a tendency to rise, it will commence flowing into the room.

It is also evident, that as the draught through the doors and windows arises from the outward pressure, to supply the chimney with about 1000 feet of air for every pound of coal consumed, it must diminish in proportion to the quantity of air that may be admitted through any other channel, and that as sufficient air may be allowed to enter through the ventilator to supply the fire, the draft can be entirely done away with, and the room be supplied with a constant stream of warm air. Warm air will not descend through a colder medium, and, therefore, the disagreeable sensation now experienced by the downward rush of air, as it enters through the present ventilators, will be wholly obviated, as each portion on entering the apartment will naturally disperse itself over the top of the room, and will gradually descend in its turn.

I have given to the accompanying sketches the most simple form, the better to illustrate the principle of construction; but any shape may be given to the stove, and the manner of admitting the warm air, the heat being regulated by increas-

ing or decreasing the opening over the fire.

Of the economy of the arrangement there can be no question; since I render available the heat of the flame that, at present, escapes up the chimney, and prevent the admission of so much cold air; and although the draft of the chimney may in some degree be impaired, by depriving the smoke of a portion of its caloric, still this loss will be more than ten-fold counterbalanced by the entire removal of the downward pressure that now exists.

The principal portion of the air now finds its way into the room through the door, and therefore the passages, staircases, and other parts of the house that have no fire in them, are always at the temperature of the external air, whereas, if the apartments in which fires are kept be supplied with sufficient warm air, each time the doors are opened, a portion of it will make its escape into the passages, and thereby warm the building generally.

For all purposes where a stove cannot, on account of dust or danger, be placed in the room itself, I propose connecting a pipe with the ashpit of the stove, (see C D, fig. 3,) such pipe to extend to the bottom of the room or cellar, and then by leaving the casing open at the bottom of the stove, a supply of warm air may be conveyed to the top of the room, by means of a large funnel or pipe (E), care being taken to prevent the escape of heat from such funnel, by surrounding it with a bad conductor of heat. A stove of this kind will draw off a quantity of air proportionate to the amount of fuel it may consume, at about the rate of 200 feet for every pound of coke consumed, the proportion and amount being, however, both increased by lengthening the flue, and the temperature of the room may be regulated by the depth of fire in the stove.

For an ordinary sitting-room, which is but occasionally occupied, it may suffice if the casing be confined to the stove, and so dispense with the funnel. To render such an arrangement as this available, it will be necessary merely to make the casing air-tight to the stove all round, to admit the air as before at the bottom, and cause it to pass over the greatest possible amount of heated surface, and then to cause it to flow into the room at the side or sides of the chimney, at about the height of 6 or 7 feet. I am, Sir, yours, &c.,

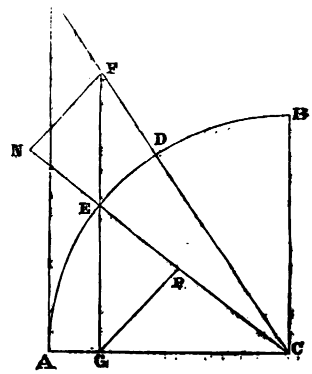
FRANKLIN COXWORTHY,
(Ordnance Department.)

London, August 12, 1844.

THE GEOMETRY OF CIRCULAR ARCS CONSIDERED AS RELATIVE AND CORRELATIVE. BY WM. S. V. SANKEY, ESQ., M.A.

Sir,—As the relation of the arc to its tangent, co-tangent, sine, co-sine, &c., is now thoroughly established, and by means of series become the subject of calculations based upon equations theoretically accurate, it appears to me that a field is open for investigating the *Geometry* of arcs considered as lines, whose values may now be taken as *known*.

Thus, supposing A C D a sector of a circle; A T, tangent of arc A D; C T secant; and let G C be so taken on radius A C, that raising the perpendicular G F,



(meeting the arc A D in E, and the secant in F,) the triangle G C F shall be equal to the given sector A C D; then, I say, $\frac{G\,C^2}{rad.\ A\,C^2} = \frac{arc\ A\,D}{tang.\ A\,T}$; for the sector A C D : triangle A C T : : arc A D : tang. A T; also triangle A C F : triangle A C T : : G C^2 : rad. A C^2; but sector A C D = triangle A C F, therefore, arc A D : tang. A T : : G C^2 : rad. A C^2; therefore, $\frac{G\,C^2}{rad.\ A\,C^2} = \frac{arc\ A\,D}{tang.\ A\,T}$ Q. E. D.

Calling arc, a, tang. A T t rad. A C, r and G C, x; then $\frac{x^2}{r^2} = \frac{a}{t}$, and making

$r = 1$; $x^2 = \frac{a}{t}$; therefore, $x^2 = 1 - \frac{t^2}{3} + \frac{t^4}{5} - \frac{t^6}{7}$, &c.; I propose to call the arc A E, which is thus intercepted, the *correlate* arc; hence, cos.² of *correlate* = $1 - \frac{t^2 \text{ of arc}}{3} + \frac{t^4 \text{ of arc}}{5}$, &c.; but from the well-known formula cos. $= \frac{1}{\text{sec.}}$, cos.² $= \frac{\text{sec.}^2}{1} = \frac{1}{1 + \text{tang.}^2}$; therefore, $\frac{1}{1 + \text{tang.}^2 \textit{ correlate}}\; 1 - \frac{t^2 \text{ arc}}{3} + \frac{t^4 \text{ arc}}{5}$, &c.; or, expanding $1 - \text{tang.}^2 \text{ cor.} + \text{tang.}^4 \text{ cor.} - \text{tang.}^6 \text{ cor.}$ &c. $= 1 - \frac{t^2 \text{ arc}}{3} + \frac{t^4 \text{ arc}}{5}$, &c.;

$\because \text{tang.}^2 \text{ cor.} - \text{tang.}^4 \text{ cor} + \text{tang.}^6 \text{ cor.}, \&c. = \frac{t^2 \text{ arc}}{3} - \frac{t^2 \text{ arc}}{5} + \frac{t^6 \text{ arc}}{7}$, &c.

Let A N be tangent of *correlate* arc A E, and call A N, z; then, since $x^2 = \frac{1}{1 + z^2}$; therefore, $\frac{1}{1 + z^2} = \frac{a}{t}$; but calling the *correlate* arc A E, u; $\frac{d u}{d z} = \frac{1}{1 + z^2}$;

therefore, $\frac{d u}{d z} = \frac{a}{t}$, or the ratio of an arc to its tangent is equal to ratio of differential of correlate to differential of its tangent.

Since the triangle A C T is to the triangle G C F (equal to sector A C D), as A T² : G F²; therefore, A T : A D : : A T² : G F²; ∴ A T : G F : : G F : A D, or G F is the mean proportional between the arc A D and its tangent A T.

From F and G, let fall the perpendiculars F O and G P upon the radius E C; it is obvious, that the area of the triangle G C F = (area of triangle G C E + area of triangle E C F =) E C or A C (G P + F O); but triangle G C F = sector A C D; therefore,

$$A C \times \frac{\text{arc A D}}{2} = A C\left(\frac{G P + F O}{2}\right):$$

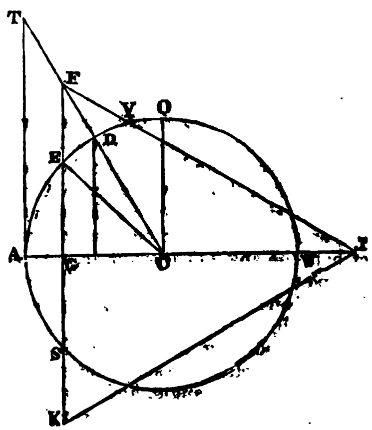
and also, arc A D = G P + F O, G P and F O, which may be considered as segments of the arc A D, are to one another in the same proportion as G E and E F the segments of G F.

It is obvious that, comparing the sector A C D with the triangle F G D, the *inset* A E G must equal the *offset* E D F.

Since $P C = \frac{G C^2}{\text{rad.}^2}$, substituting this value in the first equation, $P C = \frac{\text{arc A D}}{\text{tang. A T}}$ and arc A D = tang. A T × P C; but P C = half versed sine of twice complement to *correlate*, therefore,

$$\frac{a}{t} = \frac{\text{vers. sin. of twice compt. to } \textit{correlate.}}{2}$$

Let arc A D = 45°, then tangent A T = rad. A C; therefore,



$\frac{G^2}{\text{rad. A C}} = \text{arc A D}$. Hence P C = arc A D; consequently,

$$\text{arc } 45° = \frac{\text{vers. sin. of twice compt. to } \textit{correlate}}{2}$$

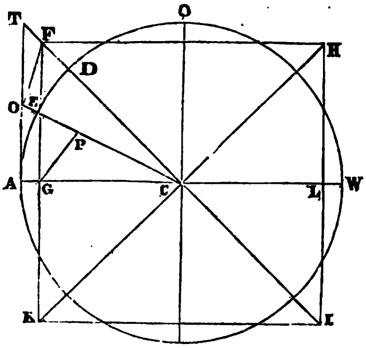
and arc 90° = versed sine of double compt. to *correlate*. In this case, taking C L equal to C G, and completing the square of G L, forming thus F H I K, this square will be equal to the area of the circle A Q W.

It is manifest that P C here is equal to the sum of the perpendiculars, G P and F O.

Let now F I K be an equilateral triangle, cutting the circle A Q W, and equal to it in area, the *offset* E F Y being equal to the *inset* A E S A = 2 A E G.

In this case A T equals $\frac{\sqrt{3}}{2}$, radius being unity, therefore,

$$\cos.^2 \text{ of } correlate = \frac{2 \text{ arc } 60^\circ}{\sqrt{3}} = \frac{\text{arc of } 120^\circ}{\sqrt{3}}$$



In this way *correlate* arcs for all *regular* figures, which are equal in area to any given circle, might be found. Having then the *correlate* arc A E, produce its sine E G to meet the secant of the angle A C D, which is complement of half the angle of *regular* figure; then the point of intersection, F, will be the *locus* of one of the angles of the proposed regular figure, equal in area to the given circle; producing the sine E G in the opposite direction, we shall obtain K, the *locus* for another angle, and so on; thus the regular figure can be described.

It would much facilitate these operations to have tables of *correlate* arcs calculated to the tabular arcs.

(*To be continued.*)

SUSPENSION BRIDGE OVER THE DANUBE.

Mr. Tierney Clark, the engineer and constructor of Hammersmith Bridge, is about adding another laurel to his fame in this kind of architecture, by the completion of a most stupendous bridge across the Danube, the foundation of which was laid with much ceremony, by the Arch-Duke Charles (as representative of the Emperor of Austria), in August, 1842. The difficulties of constructing a bridge across this deep and rapid river have been long considered insurmountable; the lowest depth of water is always above 20 feet—and in March, 1838, the river rose 36 feet above low-water mark, breaking down the embankments placed to keep it within its limits, levelling houses, and destroying life to a great extent. The continual fluctuations of such a river, and the breaking up of the ice in winter, often forming immense masses, a mile in length and 11 feet high, will give some idea of what the engineer has had to contend with; he has, however, by the erection of the most stupendous coffer-dams and ice-breakers ever known, overcome every impediment—the gigantic work is fast approaching to completion—and its successful progress, by English talent and English workmen, in, to them, a rigorous climate, will prove another monument of the superiority of British scientific and mechanical skill, and a source of perplexing annoyance to our detractors. Some idea of the magnitude of one of the coffer-dams (that for the retaining pier on the Pesth shore) may be formed from the fact, that 5,000 persons were admitted within its area to view the ceremony of laying the first stone. The following are full particulars of the dimensions, &c., of the bridge:—Distance between points of suspension, 665 feet; two side openings, each 297 feet; width of platform, 42 feet—to be supported by cast-iron beams, in one piece; height of platform above low water, 50 feet. The suspension piers, or towers, are 150 feet in height from the foundations, of solid masonry, being faced with granite to the level of the roadway; the workmanship of the granite is of the finest description; the stone is brought from the granite quarries of Manthausen, in the neighbourhood of Lintz, and distant from Pesth about 300 English miles; many of the stones weigh from 10 to 12 tons. The coffer-dam for the second suspension tower, which has been the most difficult to accomplish, has just been completed, and when cleared there will be a clear depth of 60 feet; the piles which have been necessary to construct this dam were all in one length, from 75 to 80 feet long, and 15 inches square—while of these piles nearly 2,000 have been required; and some extraordinary fine specimens of oak measured 110 feet. This will afford some idea of the stupendousness of the undertaking. The oak came from the forests of Sclavonia, in barges drawn by horses, and the fir timber from the forests of Bavaria and Upper Austria, down the Danube, a distance of some 500 English miles. The total length of the bridge, with approaches, will be about 600 yards—and it will produce, from its peculiar situation in the centre of the Autrian capital, and amidst some of the finest buildings in Europe, an imposing effect. This will be the first permanent bridge with stone piers built between Ratisbonne and the Black Sea since the time of Trajan, A.D.

103, when a bridge was built across the Danube at the Eixen Thor, or Iron-gate, situate on the confines of Hungary and Servia, and where travellers perform quarantine before entering the Austrian dominions; the foundations of this bridge are still in existence, and are pointed out to the traveller, as well as the remains of a road hewn out of the solid rock, and which, constructed in part of timber, overhangs the river.—*Mining Journal.*

CAPTAIN WARNER AGAIN.

The *Times* of the 21st inst. contains a letter from Captain Warner, in which, after a good deal of abuse, unnecessary to be repeated, of Sir Charles Napier and Captain Pechel, for their incredulity on the subject of the Captain's "grand secret," he makes the following bold offer:—

"But I will here, in the face of the world —for what is published by the press of England is read by the whole world—and that there may be no further mistake, misunderstanding, or misapprehension about the matter, repeat the offer I instructed Sir C. Napier, in terms of his own dictation, to submit to Her Majesty's Government:—If the Government will anchor a line of battle ship at the back of the Goodwin Sands, out of the ship-track, so that no harm may happen to passing vessels, I WILL FROM ON BOARD ANOTHER SHIP DESTROY HER AT A DISTANCE OF FIVE MILES. I am willing to take on board the vessel in which I operate, General Sir George Murray, Captain Lord Viscount Ingestre, R.N., Captain Dickinson, R.N., and Captain Henderson, R.N., who shall have every opportunity of inspecting my mode of operation, and satisfying themselves that on this occasion I use a projectile.

"The kind liberality of my friends enables me to exhibit this experiment without asking the Government for a shilling towards it. If I fail, I am to receive nothing but ridicule; of which I have received quite enough to satisfy any reasonable man already.

"But previously I require a guarantee from Her Majesty's Government for its purchase of my secret for 300,000*l.*, in the event of my destroying the ship and satisfying the four above-named officers of the feasibility and practicability of my plans.

"Lastly, I invite Sir Howard Douglas, Sir Byam Martin, Sir George Cockburn, Colonel Chalmer, R.A., and Commander Coffin, R.N., to attend in another vessel and watch the proceedings."

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

THOMAS DRAYTON, OF BRIGHTON, *for improvements in coating glass with silver, for looking-glasses, and for other uses.* Patent dated, November 25, 1843; Specification enrolled, May 25, 1844.

The invention which forms the subject of this patent is one which has already acquired considerable notoriety from the promise which it offers, of entirely superseding the use of quicksilver for looking-glasses. The patentee substitutes a solution of silver which he obtains and applies in the following manner. He mixes together one ounce of roughly pulverized nitrate of silver, half-an-ounce of spirits of hartshorn, and two ounces of water, and allows the mixture to stand for twenty-four hours; he next passes it through a filter, (preserving the deposit, on the filter, which consists chiefly of silver,) and adds three ounces of spirits of wine, at 60° above proof, and between twenty and thirty drops of oil of cassia; the solution is then allowed to rest for six hours longer, after which it is fit for use. The glass, which must be previously well cleaned and polished, is then covered with the solution to the depth of from an eighth to a quarter of an inch. From six to twelve drops of oil of cloves, diluted with spirits of wine, in the proportion of one part of the former to three of the latter, are then dropped here and there into the solution, and at intervals during an hour or two, which causes a deposition of silver sufficient to coat the glass uniformly and completely. The exhausted solution is then poured off and taken care of, in order to be re-employed with some fresh solution. When the silvered surface of the glass has become perfectly dry, it is varnished or coated with a composition made of equal quantities of bees wax and tallow. The patentee finds that every square foot of glass requires no more than about 18 grains of nitrate of silver. His claim is to the deposition of silver on glass "from a solution of that metal by deoxidation, in such manner as to cause the silver to adhere to glass without any previous coating of the latter."

JOHN SYLVESTER, OF GREAT RUSSELL-STREET, BLOOMSBURY, ENGINEER, *for improvements in applying heat to brine or other matters contained in vessels.* Patent dated, December 13, 1843; Specification enrolled, June 13, 1844.

In the evaporation of brine, as well as many other manufacturing processes, it is of the utmost importance to be able to command, permanent and uniform degrees of

temperature much exceeding 212° Fahr.; but where the vessels are exposed to the direct action of fire and flame, this is impossible. Mr. Sylvester proposes to effect this object, "by employing a column of fluid, and by preference water, in connexion with and acting upon fluid submitted to be heated, whereby, according to the height of such column, so will be the temperature maintainable in such fluid, the temperature whereof may be varied from time to time, by increasing or diminishing the height of the column." The mode in which Mr. Sylvester works out the principle thus enunciated, is as follows:—

"I have a pipe (which is only necessary to be of small diameter), of greater length than is necessary for obtaining and maintaining the highest temperature required for the process to be carried on in the vessel which contains the brine or other matter, and I apply a cock at the lower end of such pipe, so that I can readily draw off any quantity of the fluid when necessary to reduce the temperature; and having obtained the desired temperature, it will be evident that, by the means herein set forth, that temperature may be maintained for any length of time; and then, by increasing or diminishing the height of the column of fluid, I can augment or diminish the temperature, and again maintain such new-regulated temperature for any length of time; hence it will be seen that processes requiring one constant and uniform temperature above 212° of Fahrenheit during the whole time of process, may readily, when the desired temperature has been adjusted by the proper height of column, have that temperature maintained, whilst other processes requiring different temperatures maintained for a given time at different periods of the process, may, with great facility, have such temperatures obtained and maintained for any desired length of time. The vessel containing the brine or other matter is to be placed within another vessel, both being of sufficient strength to resist the pressure of the column of fluid necessary for maintaining the required temperatures of the processes carried on in such vessel, and there should be a space between the inner and outer vessels of about two or three inches, for containing the fluid employed on which the column of fluid exerts the required pressure; and under the outer vessel is placed a suitable furnace or fire-place for heating the fluid between the vessels, with a damper to regulate the same, so as at all times to be enabled to maintain such brine or other matters at the highest temperature which the column of fluid in the pipe in connexion with the fluid contained between the inner and outer vessels is capable of maintaining. I have not thought it necessary to enter into a description of the nature of various vessels in which processes are carried on requiring higher degrees of heat than 212° of Fahrenheit, they being well known and form no part of my invention; and persons accustomed to such work will readily apply outer vessels to contain such inner vessels, leaving spaces between them for the fluid as above explained. A column of water of thirty-two to thirty-four feet high will allow of a temperature of about 250° of Fahrenheit being maintained: hence the pipe in connexion with the space between the outer and inner vessel should be of that length in a perpendicular direction for processes requiring a temperature approaching or below that temperature; and when greater temperatures are desired to be maintained, a higher column is to be used; and it may be remarked, that a suitable force pump should be applied to the column pipe, so as by forcing water into it to increase the column of fluid therein, and thus, when desired, afford the means of maintaining a higher temperature."

"*Claim.*—What I claim is the mode of heating brine and other matters in vessels, by applying a column of fluid, so that it may act by its pressure on the fluid medium with which it is connected, and to which heat is to be applied, in combination with other apparatus, as herein described, in such manner as to obtain and maintain desired temperatures above 212° of Fahrenheit, without subjecting the vessels employed to greater pressure than is due to the column of fluid."

FREDERICK STIENER, OF HYNDBURN COTTAGE, NEAR ACCRINGTON, TURKEY-RED DYER, *for a new manufacture of certain colouring matter called Garancine.* (Being a communication from abroad.) Patent dated Aug. 8th, 1843; Specification enrolled February 8th, 1844.

The colouring substance called garancine has been hitherto obtained only from fresh madder; the present patentee obtains it from spent madder, or such madder as has been already used in dyeing. His process is as follows:—"Outside the building in which the dye-vessels are situate, a large filter is formed, by sinking a hole in the ground, and lining it at the bottom and sides with bricks, without any mortar to unite them. Upon the bricks a quantity of stones or gravel is placed, and over the stones or gravel common wrappering, such as is used for sacks; below the bricks is a drain, to take off the water which passes through the filter. In a tub adjoining the filter, a quantity of dilute sulphuric acid, of about the specific gravity of 1·050, (water being

1·000,) is kept. Hydrochloric acid will answer the several purposes for which sulphuric acid is used; but the patentee prefers sulphuric acid, as more economical. A channel is made from the dye-vessels to the filter. The madder which has been employed in dyeing, and which is in the state considered as spent or refuse madder, is run from the dye-vessels to the filter; and while it is so running, a portion of the dilute sulphuric acid, sufficient to change the colour of the solution, and the undissolved madder, to an orange tint or hue, is run in, and mixed with it. This acid precipitates the colouring matter which is held in solution, and prevents the undissolved madder from fermenting, or otherwise decomposing. When the water has drained from the madder, through the filter, the residuum is taken from off the filter, and put into bags. The bags are then placed in a hydraulic press, to have as much water as possible expressed from their contents. In order to break the lumps which have been formed by compression, the madder, or residuum, is passed through a sieve. To five hundredweight of madder, in this state, placed in a wooden or leaden cistern, one hundredweight of sulphuric acid of commerce is added, by sprinkling it on the madder through a leaden vessel, similar in form to the ordinary watering-can used by gardeners. The madder is then worked about, so as to mix it intimately with the acid. In this stage the madder is placed upon a perforated leaden plate, which is fixed about five or six inches above the bottom of a vessel. Between this plate and the bottom of the vessel a current of steam is introduced, by a pipe, so that it passes through the perforated plate, and the madder which is upon it. During this process, which occupies from one to two hours, a substance is produced, of a dark-brown colour, approaching to a black. This substance is garancine, and insoluble carbonized matter. It is next thrown on the floor to cool; and, when cool, is placed upon a filter, and washed with clear cold water, until the water passes from it without an acid taste. The substance is then put into bags, and subjected to hydraulic pressure; it is next dried in a stove, and ground to a fine powder under ordinary madder stones, and afterwards passed through a sieve. In order to neutralize any acid that may remain, for every hundredweight of this substance, from four to five pounds of carbonate of soda, in a dry state, are added, and intimately mixed therewith; the garancine in this state is ready for use."

Isabella Larbalestier, of Noble-street, Falcon-square, Furrier, etc., *for Improvements in making certain Skins resemble the Sable Fur.* Patent dated, February 26, 1844; Specification enrolled, July 27, 1844.

The skins being previously dressed, are first to be covered over with a "killing" of slacked lime, made in the proportion of one pound of lime to a gallon of water; this "killing" is to be put on the hair surface of the skin lightly with a brush, and allowed to remain on for twelve hours, after which it is to be thoroughly beaten off; it is then to have a coat of the colouring composition put on, made of the following materials:—

Three pounds of roasted gall nuts; four ounces of sal ammoniac; fourteen ounces of sumach; twelve ounces of black antimony; two ounces of verdigris; ten ounces of lettirsedge; four ounces of copper-dust; ten ounces of argil.

These materials are to be reduced to a fine powder, and then gradually mixed with nine gallons of water, care being taken that the whole is smoothly mixed together; then apply with a brush a coat of these materials over the surface of the skins, and allow them to remain for twenty-four hours, laying each two skins together with their hair surfaces touching each other; care must be taken that they do not become heated. After they have remained for twenty-four hours, the skins are to be well beaten, and the process is to be repeated until the skins are made of the colour required. They have to be cleaned, which is done by putting them into a closed cylinder with sand and mahogany saw-dust, and giving a rotary motion to it for about two hours, taking care that the temperature is not less than blood heat; after this process of cleaning, the skins will be in a fit state for the market.

Charles Townend, of Manchester, Fustian Manufacturer, *for an improved process or manufacture whereby cotton fabrics are aided and made repellant to water and mildew, and any unpleasant smell is prevented in such fabrics.* Patent dated, March 6, 1844; Specification enrolled, May 4, 1844.

Although "cotton fabrics" are spoken of generally in the title of this patent, the processes described are stated to be chiefly applicable to those fustian cloths, commonly called "beaverteens." How they are "aided" thereby, or what is really meant by this odd phrase is not explained; (*query*, whether it may not be the *fustian* for *strengthened?*), but so far as respects the tendency of their "repellant of water and mildew, &c.," the processes described are of likelihood enough to merit quotation at length:—

"Take eight gallons of cold water into a vessel or vat, and add thereto twenty pounds of calcined British gum, and mix them well together until fine and pasty then take

seven gallons of boiling water in another vessel or vat, and add thereto ten pounds of palm or white soap cut into small pieces, and when thoroughly dissolved add this solution to the above gum mixture; then put in one pint of logwood liquor and boil them up together, then add thereto three pounds of common or rock alum in its crystallized state, and for the purpose of rapid dissolution, I prefer that the alum should be previously ground or pulverised, and well boiled or dissolved in one gallon of water; boil the whole up together for a few minutes, and the mixture will then be ready for use. The cloth or fabric intended to be saturated, having been previously prepared and dyed, is to be introduced into a suitable vessel containing the above mixture, and to be steeped in or drawn or passed through the same in the usual manner of stiffening and drying cotton fabrics. It will be found that the cloth which has been submitted to the above process will be aided and be entirely divested of or free from any unpleasant smell, and have a non-absorbent property, in fact, be repellant to water, and will also have a preventive finish against mildew, and the colour and feel of the cloth will be much improved.

"I also wish it to be understood, that I have found that the following combination of solution and of mixture will produce a similar result, viz., for the solution, boil six pounds of sulphate of zink (white vitriol) in nine gallons of water; allow it to get cold and settle, then draw off the clear solution, leaving the sediment; then take eight gallons of cold water, and add to it twenty pounds of calcined British gum, and mix them well together until fine and pasty, then take eight gallons of boiling water, and add to it ten pounds of palm or white soap cut into small pieces, and when thoroughly dissolved, add to it the last-mentioned gum mixture, add also a quarter of an ounce of pearl-ash, and bring them up to a boiling heat; the mixture is then ready for use.

"The cloth or fabric intended to be saturated, having been previously prepared and dyed in the usual way, is to be first steeped in, or drawn or passed through, the last-mentioned mixture, in the usual manner of stiffening and drying cotton fabrics."

GARRETT'S THRASHING MACHINE.

Sir,—We wish to call your attention to an error in your description of our last specification, for improvements in chaff-cutters, drills, and thrashing machines; as far, at least, as the last implement is concerned. You say, "Mr. Garrett also lays claim under this patent to 'making the drum or beating cylinder of thrashing machines of IRON instead of wood;' but this is a claim which would hardly hold good in law."

We do *not* claim the privilege of making the *drums of iron*, but we do claim the *particular form* of *making them* of iron AS DESCRIBED IN OUR SPECIFICATION. The following are the exact words of our specification:—"In reference to this part of my invention, I claim constructing the drum or beating cylinder of thrashing machines of iron AS ABOVE DESCRIBED."

We remain, Sir, yours faithfully,
RICHARD GARRETT AND SON.

Leiston Works, Saxmundham, Suffolk,
August 20, 1844.

NOTES AND NOTICES.

Periodical Meteors.—An unusually splendid display of these extraordinary phenomena was observed at Bruges, in Flanders, on the nights of 9th and 10th of August. The 10th of August has long been known to be the day on which these meteors appear. This year they began on the 9th, when 17 were witnessed between 9 and 11 o'clock, but the principal apparition of them was on the 10th, when Dr. Forster, who had made previous arrangements for having them counted, was enabled to estimate their average number, which appeared to be about 96 per hour, of which above 75 had a demonstrable point of convergence in some part of the heavens, not far from Antares in Scorpio. Besides these a vast number of fine white lines, like narrow discharges of the electrical spark, appeared aloft, and had the same direction towards Scorpio, all tending to the W. S. W. horizon.—*Times.*

Ocean Steam Navigation.—The line of steam communication between England and America was established in 1838, by the *Great Western* steamship, and maintained by that vessel, the *British Queen*, and the unfortunate *President*, till 1842, without the support of government or any contract for conveying the mails. The line to Halifax and Boston was established by Mr. Cunard, on obtaining a government contract of 57,000*l.* per annum to convey the mails 186,300 miles. The line to the West Indies was established in 1842 by parties who, in 1840, took a contract for 240,000*l.* per annum to convey the mails 684,816 miles. The line to Malta and Alexandria was established in 1840-1 by the Peninsular Company, who took a contract for 31,000*l.* per annum to convey the mails 72,000 miles. The line between Calcutta and Suez was established in 1842 by the India Steam Company of Calcutta, but no assistance has been granted by government for the mails. The line between Calcutta and Suez in 1843 and 1844 was (and is now) occupied by the Peninsular Company's vessels, with a grant of 20,000*l.* per annum for five years from the Indian government, on condition of their performing 38,080 miles in the first year, 57,120 miles in the second, and 114,200 in the third.

Royal Steam Navy.—The *Amphion*, 36, now building at Woolwich, is to be propelled on the screw principle; but the steam power is to be auxiliary only, and to be used occasionally. Her store of coals will be only sufficient for five days' regular steaming, independently of her sails.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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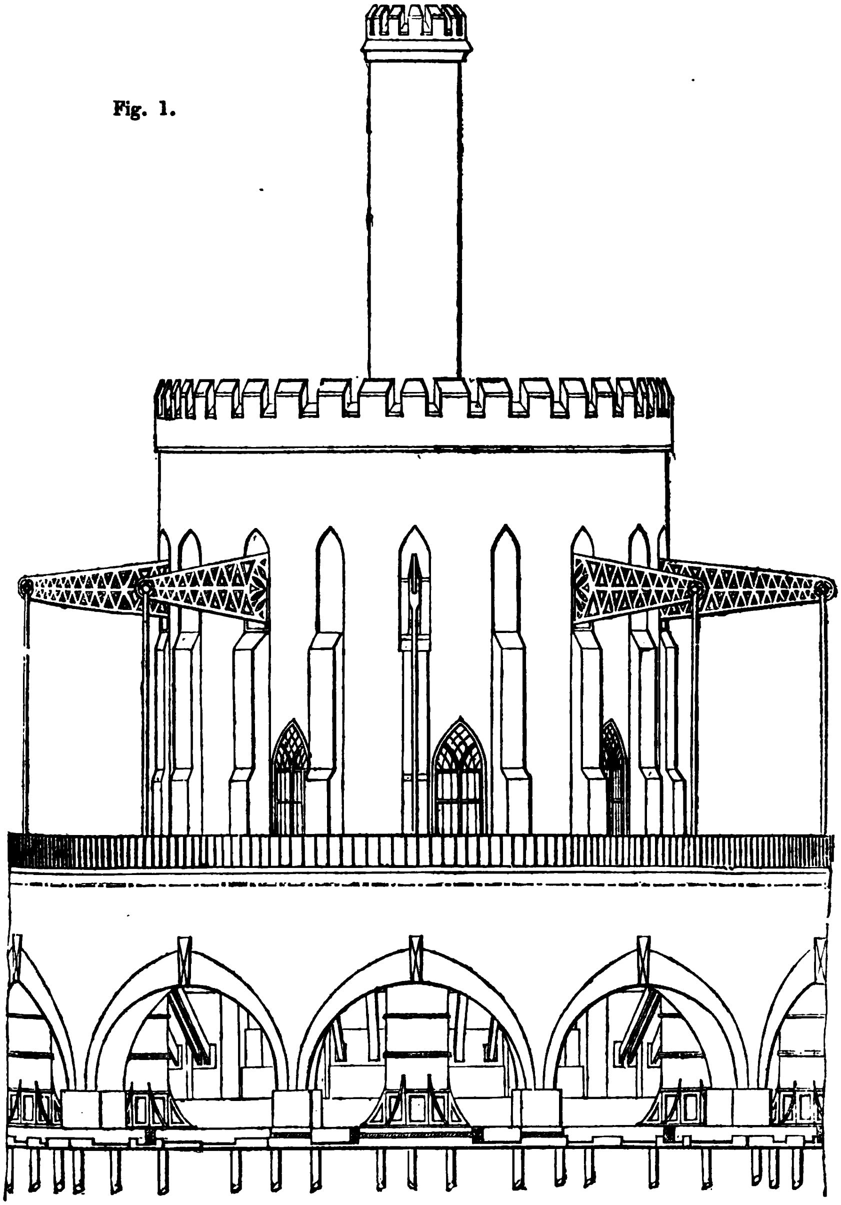
DRAINAGE OF THE LAKE OF HARLEM.

Fig. 1.



DRAINAGE OF THE LAKE OF HARLEM.

[Translated from Jobard's Bulletin du Musée de L'Industrie for the *Mechanics' Magazine*.]

Holland is engaged at this moment in a work which merits the attention of Europe; it is the drainage of the Lake of Harlem, whose waters cover a space of more than 18,000 hectares (46,436 Imp. acres nearly).

In 1531, this lake scarcely occupied a third of its present area; three villages which were then to be seen on the north-east side have been since then engulphed, the first in 1591 and the two others in 1647. The waters which then divided themselves into several meres, have since overflown the barriers which divided them, and now form but one vast sea, which menaces at every storm the existence of all the surrounding lands.

For more than two hundred years the necessity of effecting the drainage of the lake has been talked of. In 1643, an engineer of the name of Leeghwater, a simple millwright of Ryp, published a small work on the subject, intituled *Het Haarlemmer-meer-boek* (the Book of the Lake of Harlem), a 13th edition of which appeared in 1839.

Various plans for the accomplishment of the object were promulgated at successive epochs, but still no decisive resolution had been come to, when in November 1836, a violent tempest from the west, drove the waters of the lake up to the very gates of Amsterdam, and a month later, another tempest, no less violent, carried them as far as the city of Leyden. By the first of these catastrophes, 4,000 hectares (about 10,870 Imp. acres) of land were submerged; and by the second, 7,500 hectares (about 18,522 Imp. acres), everywhere the most extensive and costly repairs were required, and it was more than a year before the inundated lands were completely recovered.

The Dutch Government now saw that it was high time to do something, and a decree was passed by King William I., 7th August, 1837, which recites that the experience of the preceding winter having demonstrated the necessity of devoting special attention to the question of draining the lake, His Majesty had appointed a commission to enquire into all the plans which had been proposed for the purpose, and to submit before November 1837, some definitive scheme with an estimate of the expense.

The commission terminated its labours on the 24th October; it proposed the measures, which it thought best to be adopted, and estimated the expense at 8,355,000 florins (696,250*l.*)

A project of law authorising the creation of stock for the execution of various public works, and especially the drainage of the Lake of Harlem was brought into the second chamber of the States General in February 1838, but rejected in April by a majority of 26 to 2. The chamber, at the same time, desired it to be understood that they were not opposed to the drainage of the lake, but only to entering simultaneously on so great a number of large undertakings.

By another project of law, which the Government sent to the same legislative Chamber in December, 1838, it was proposed to raise for the drainage of the lake alone, a loan of 8,000,000 florins (666,666*l.*), and in March, 1839, the Chamber gave its assent by a majority of 45 to 5.

A new commission was then appointed for the special purpose of superintending the execution of this great enterprize.

According to the plan which has been definitively determined upon, the drainage will embrace an area of 18,100 hectares (about 46,688 Imp. acres), which are covered with water to the mean height of 4 metres (4·37453 yards), making altogether a total of 724 millions of cubic metres (each = 1·308022 Imp. cubic yard). And while causing this immense volume of water to disappear, the great inland navigation, which is fed through this channel, is not to be in the least diminished.

To effect this result the whole of the lake is to be enclosed by a dike, which will be 59,500 metres (about 65,065 Imp. yards) in length; of which 2780 metres will have to be constructed in the midst of the water, upon fascine work; and parallel to this dike throughout its entire length (with the exception of the part carried through the water) there is to be a large canal cut, which, while it satisfies all the wants of the navigation, will conduct directly to the sea the surplus

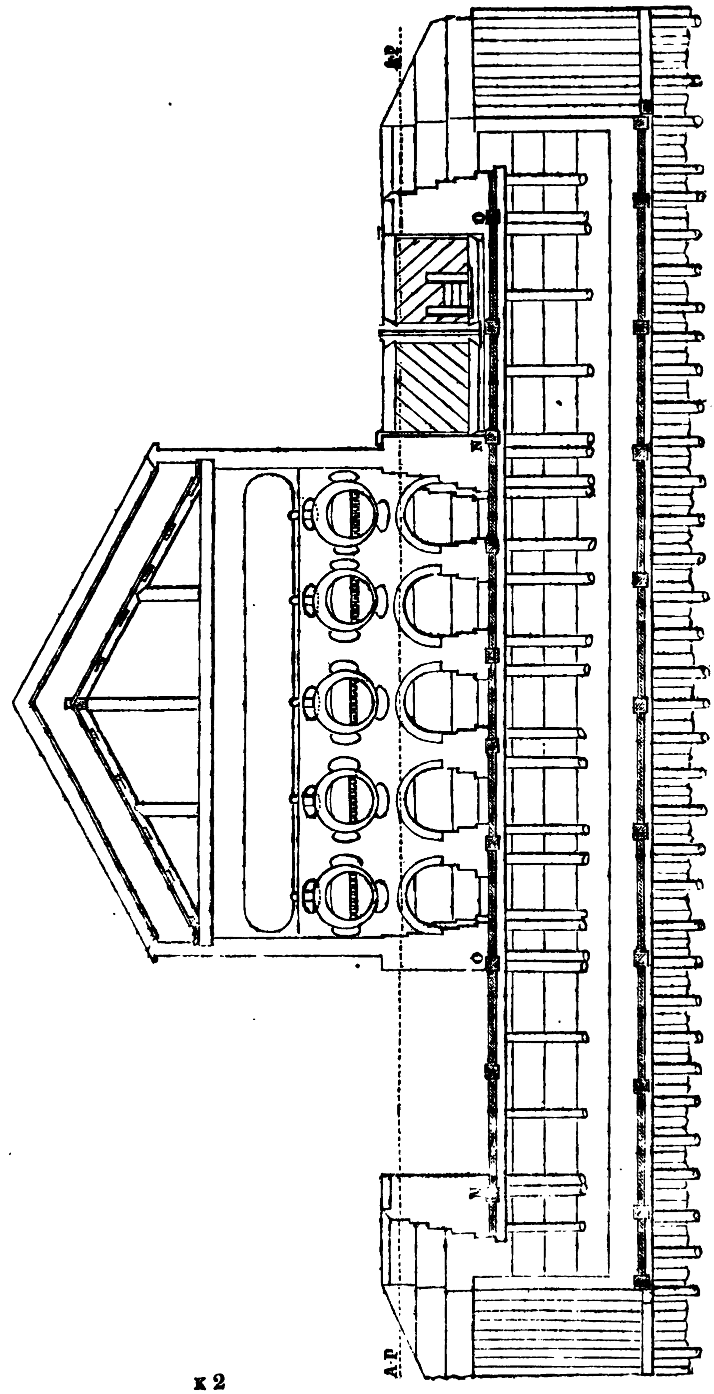


Fig. 3.

waters which previously spread themselves over this immense reservoir. The canal and dike are to be made at the same time; so that the soil excavated for the one may serve for the erection of the other.

With respect to the 724 millions of cubic metres of water which the lake will contain when the embankment is finished, it is not proposed to discharge it directly into the sea, but into the reservoir (boezem) of Rhynland, whence it may be conducted into the sea by the Katwyk passage, by the Spaarne, and, if necessary, by a sluice which they are now constructing at Haefweg.

The lake must, however, not only be drained, but the area gained must be kept dry afterwards; and to accomplish this it is calculated that a power must be provided which, in unfavourable seasons, shall be equal to the discharge of 36,200 cubic metres of water, raised 5 metres high; and the power required to do this will, it is supposed, be adequate to the previous drainage, because it will be applied continuously, and the water has not to be raised so high (4 metres only).

Steam has been the only power thought of for the purpose; to be applied either to pumps, or to Archimedean screws, or to scoop wheels. The last are the least advantageous instruments that can be employed, looking to the effect produced; but it is a question to be decided by experience whether they are not, on other accounts, to be preferred.

It is calculated that a power of from 1080 to 1200 horses will be required, reckoning the useful effect of each horse to be equivalent to 4 cubic metres of water raised one metre high per minute by means of pumps, or 3½ cubic metres raised the same height, and in the same time, by means of scoop-wheels. This power will be represented by three machines of 360 to 400 h. p., or by six machines of from 180 to 200 h. p., to be stationed at three points, Kaag, Spaarne, and Lutke-Meer.

In June, 1842, the design of the edifice was definitively determined upon, in which the first of these engines is to be erected. It is called the *Leeghwater*, after the ingenious person who, two centuries ago, first conceived the idea of this grand operation. The name, besides, has in Dutch a signification which is analogous to the operation itself. The site chosen for it, is on the south side of the lake, near the village of Kaag, on account of the facilities which the canal and sluices of Katwyk offer for the evacuation of the waters.

Fig. 1 of the accompanying engravings is an elevation, and fig. 2 a ground plan, of this building. Figs. 3 and 4 are elevations of the engine on the lines A B and C D.

The engine is so different from all others, that it may be useful to give here some details of its construction; and in doing so it will be necessary to premise a word or two on steam engines in general, in order that the reader may fully comprehend the motives which have led to the adoption of a form of construction apparently so strange.

In the single-action machines of Watt the steam enters from the boiler into the cylinder above the piston, which being pressed down by the steam, draws down with it the end of the balance beam, to which it is connected by a rod, and raises the weight attached to the other end of the beam. After this effect has been produced, the steam is shut off from the boiler, and a communication opened between the top and bottom of the cylinder, whereby the steam which has acted above the piston, passes beneath it, and exerts on both sides an equal pressure. The piston is then in a state of equilibrium between the two pressures, whence the valve which opens and closes the above communication has received the name of the equilibrium valve. During the return stroke of the piston, which is effected by the pressure of the counterpoise, the equilibrium valve is still kept open, and the equilibrium maintained; but when the piston arrives at the top, the equilibrium valve is closed, the steam is carried off into the condenser, and a new supply admitted from the boiler to the top of the cylinder as before.

Machines such as these have been employed in several places in Holland for drainage.

The single-action engine of Watt has undergone a modification when applied to forcing pumps for the raising of water from the deep mines of Cornwall. The enormous weight of the rods of these pumps suggested the idea of employing the steam to raise them, while they by their own weight should raise the water. For in the Cornwall engines

the action of the steam serves merely to raise the counterpoise, the descent of which not only raises up the piston again, but produces at the same time the useful effect. In other respects, the Cornwall engines are the same as that of Watt,

Fig. 1.

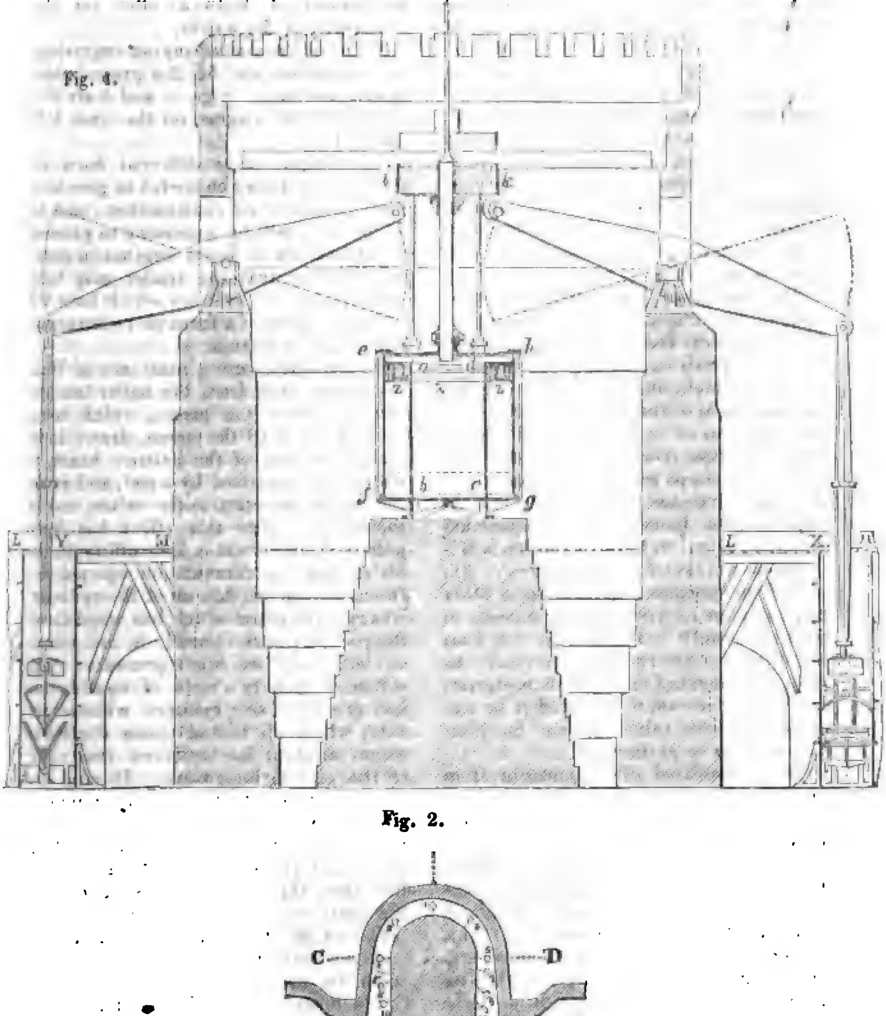
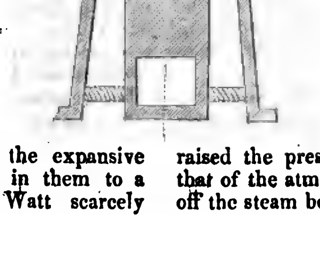


Fig. 2.



with the exception that the expansive principle is carried out in them to a much greater extent. Watt scarcely raised the pressure of the steam above that of the atmosphere, and did not shut off the steam before the piston was at the

bottom of the cylinder. In Cornwall, the pressure is carried up to four atmospheres, and during the greater part of the stroke, even to the extent of from two-thirds to three-fourths, the steam acts expansively. Before the closing of the communications, the pressure of the steam is much stronger, and after the closing it is much weaker than the resistance to be overcome; the consequence of which is a great inequality in the velocity of the piston, which performs but one part of its stroke with rapidity.

The single-action engines of Cornwall have acquired great celebrity for the small quantity of fuel which they consume; and in applying them elsewhere, great attention has been paid to everything by which that result can be supposed to be influenced. Of this the London pumps worked by Cornish engines are a proof. These pumps do not raise the water from such a depth, that the weight of the rods could be employed as a useful weight; and this has led to their loading them with an additional weight, and so imitating completely the Cornish system.

For the raising of the waters in Holland, it is especially important to have machines which will consume the least possible quantity of fuel, and this has naturally led to a preference being given to the Cornish machines, but it is obvious, that for this particular purpose they must be still farther modified. To raise the water to a small height, it is better to employ suction than forcing pumps, in which case the water is raised by the ascending, and not by the descending movements of the pistons. And applying this principle to the Cornish machines, the steam should be introduced from the boiler into the cylinder, not above but under the piston, and instead of loading the pump-rods as is the London practice, the piston-rod, on the contrary, should be loaded with a surplus weight. In this manner, during the action of the steam, and the upstroke of the piston, a weight is raised, which by its descent, produces the effect desired.

To remove all doubts, it has been deemed proper to introduce another change still more important. We have adverted before to the velocity of the piston during part of the stroke. This velocity is naturally communicated to the pumps, if as usual they are attached to one of the ends of a cross beam, and the piston-rod to the other. In truth, however, this great velocity would occur only on the descent of the pistons, when the valves were not loaded, but as the latter must be very large and heavy to furnish the necessary counteraction, the risk of injury from concussions would be proportionally increased. For this reason, it was resolved that the beams of the pumps should not be attached to the piston, so that during the action of the steam the movements of the piston and pumps should be altogether independent of one another.

From these explanations may be readily deduced, the considerations which have influenced the choice of the engine which has been adopted. The designers of it are Messrs. J. Gibbs and A. Dean,* English engineers. It is distinguished by having two cylinders one within the other, so that the steam after acting by expansion in the small cylinder during the ascent of the piston, shall be farther expanded in the large one during the descent of the piston. The advantage of this method has been already demonstrated by the engine of Sims; † but, in the latter, the two cylinders are placed the one above the other, and require lofty engine-houses; the placing of the one cylinder within the other, offers all the advantages of the system without its inconveniences. If the trial should be unsuccessful, the result will be but the loss of a comparatively small sum, since the engine in that case will still work like any other; while on the other hand, should it succeed, the advantages gained will be considerable.

The small cylinder, *a b c d*, is about 7 feet in diameter; the larger, within which the other is placed, about 12 feet. The cylinders have no communication at bottom, but at the top only. The piston *z* moves in the small cylinder, and another piston, Z Z, of an annular form, in the large one. The two pistons are connected by five rods. The middle one which is the heaviest, is attached to the interior piston; the four others are at-

* Query *Don*.—Mr. Alexander Don is, we believe, the gentleman meant.—Ed. M. M.

† For a description of Mr. Sims' engine, see *Mech. Mag.*, No. 1045, p. 138.

tached to the four segments of the annular piston. The five rods support a strong circular box, *i k*, to which they are firmly secured; and in this box are placed weights, which may be increased or diminished according to circumstances. When the two pistons are at the bottom, as indicated by the dotted lines in the section *c d*, the steam enters from the boiler into the cylinder under the small piston. The latter is then pushed to the top of the cylinder, and raises with it the annular piston, and consequently the box with its weight. When the piston has traversed a part of the cylinder, the steam is cut off, and acts expansively until the moment when the pistons attain the top of the cylinder, as indicated in the figure. During this time the pistons of the pumps will, by their own weight, and independently of the steam, have descended to the bottom, and in so doing have brought the opposite ends of their cross beams below the weights' box; on which the equilibrium valve will open, and consequently the communication between the bottom of the exterior cylinder and the bottom of the two cylinders will also be opened. The interior piston will be in equilibrium between the two lower and upper pressures during all the rest of the stroke, but in an inverse sense, while the annular piston will be pushed, by the expansion of the steam, to the bottom of the cylinder, since at the bottom of that piston there exists a communication with the condenser. The loaded pumps are partly relieved by the descent of the counterpoise, and partly by the pressure of the steam on the annular piston, which has already acted on the interior cylinder. After the descent of the piston, the equilibrium valve is shut, the steam passes off to the condenser, and a new admission of steam into the interior cylinder takes place, to be worked as before.

The stroke of the steam piston, as also that of the pumps, is 3 metres (about 7½ English feet), and the diameter of the latter 1·60 metre; thus each pump will raise at each stroke of the piston 6 cubic metres of water.

The building in which the engine is placed consists simply of a round tower, with a boiler house attached. The number of pumps is to be eleven. The distribution of these, as shown in the engravings, requires some explanation. The pumps 1, 8, and 9, are placed at an angle of 120° in respect of one another; consequently, their pistons, when loaded, will be in equilibrium under the weights' box; and so also the pumps 3 and 10, 5 and 6, 7 and 4, 11 and 2, will be respectively placed opposite, so as to be in equilibrium the one with the other. In this way either all the 11 pumps may be worked at once, or nine only, leaving out two opposite pumps; or eight, omitting 1, 8, 9; or seven, by excluding two opposite pairs; and so on, the number of working pumps may be diminished successively, one by one, till there are only three at work. Now these three pumps, by ten strokes of the piston, will raise 180 cubic metres of water per minute; and as, after the drainage of the lake, it will be necessary, in order to keep the area dry, to raise that quantity of water per minute 5 feet high, that will be equivalent to a quantity of 900 cubic metres raised 1 metre.

Thus if we suppose, that the Leeghwater working with a velocity of 10 strokes per minute, will exert only a force of 200 horses, its eleven pumps will suffice to obtain the desired result; but if the force really exerted should be from 350 to 400 horse power, the six pumps or three opposite pairs will suffice, after the drainage, to perform the duty required.

It is probable that in either case it will be found preferable to make use of a greater number of pumps and work them slower, and the arrangements are such, as to allow of any course being adopted in that respect which may be judged best. However, at the commencement, when the height to which the water is to be raised is not so great, there can be nothing to prevent the eleven pumps from being employed at once, even at 10 strokes per minute.

The general result of what has been stated is, that by the action of the eleven pumps, 66 cubic metres of water may be raised by each piston stroke, making 660 cubic metres per minute, 33,600 per hour, and 950,400 every 24 hours.

The water, as it is raised, will flow over into a trough, which is separated from the reservoir by the sluices N. O. As soon as the pumped-up water rises in the trough above the height of the water in the reservoir, the two sluices open of themselves and allow it to escape; so that the pumped-up water of the lake never rises higher than just above the level of the reservoir; consequently, the

lower the latter, the less force the engine will have to exert. The Leeghwater will never, therefore expend any of its power uselessly; which is very different from the case of Archimedean screw mills, which must always raise the water to a given height.

The contract price of the building for the reception of the Leeghwater, was 161,000 florins (about 14,250*l.*). It is a colossal edifice, in which solidity has been, very properly, the first object of care.

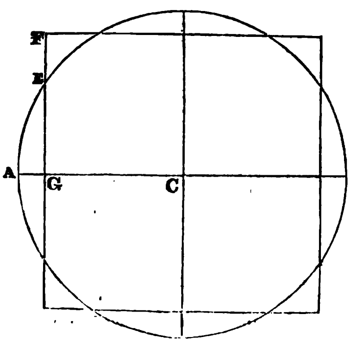
The steam engine, as well as the pumps and pipes, have been furnished by the Cornish Houses of Fox and Co., and Harvey and Co., but the beams and boilers by Messrs. Paul Van Vlissengen and Dudok Van Heel, of Amsterdam.

It is expected that the apparatus will be at work in the course of the present year, that in 1845 the embankment of the Lake will be completed; and that should no unforeseen obstacle arise, the whole of this great undertaking will be completed in about the end of 1846.

THE GEOMETRY OF CIRCULAR ARCS CONSIDERED AS RELATIVE AND CORRELATIVE. BY WM. S. V. SANKEY, ESQ., M.A.

(Continued from page 124.)

It might be interesting to apply the formula $\cos.^2$ of cor. $= \frac{a}{t}$ to some particular cases; thus, when $t = a^3$, then $a =$ sec. of cor.; for, substituting the value of t in the general formula, it becomes $\cos.^2 \text{cor.} = \frac{a}{a^3}$; $\therefore \cos.^2 \text{cor.} = \frac{1}{a^2}$, and $\cos. \text{cor.} = \frac{1}{a}$; but $\cos. \text{cor.} = \frac{1}{\text{sec.}}$, cor; $\therefore$ sec. cor. $= a$. Again, when $a =$ cot. a,



then cot. cor. $= a =$ cot. a; for cot. $a = \frac{1}{t}$; therefore, $\cos.^2$ of cor. $= \frac{1}{t} \times a = a^2$; $\therefore$ cos. cor. $= a$. Here we may remark G F = radius, also A T $= t =$ sec. of cor. When arc = radius, then $\cos.^2$ cor. $= \frac{1}{t} =$ cot. a; consequently, cot. arc. $57° \, 17' \, 44'', \, 45''' = \frac{1}{2}$ vers. sin. 2 cor. arc; also $t = 1 + \text{tang.}^2$ of cor.

If $t = 4\,a$, then cor. $= 60°$; for $\cos.^2$ cor. $= \frac{a}{4\,a} = \frac{1}{4}$; therefore, cos. cor. $= \frac{1}{2}$, which is the cosine of $60°$.

It is obvious that G F here $= \frac{1}{2}\,t = 2\,a$. From the formula $\cos.^2$ cor. $= 1 - \frac{t^2}{3} + \frac{t^4}{5} - \frac{t^6}{7}$ &c.; reverting the series, we can obtain the value of t in terms of cos. of *correlate*. Thus, given any arc, and taking it as a *correlate*, we can find the corresponding arc.

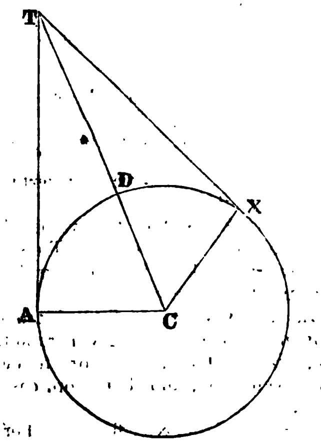
In this way we can find an arc whose tangent shall be in any given ratio to the arc, viz., by taking $\cos.^2$ cor. to rad.^2 in the given ratio, and then from $\cos.^2$ cor. $= 1 - \frac{t^2}{3} + \frac{t^4}{5}$, &c., find t. For example, taking $\frac{1}{10}$ rad. for cos. cor., then $\cos.^2$ cor. $= \frac{1}{100}\,\text{rad.}^2$, therefore $t = 100\,a$. Again, rad. being unity, making cos. cor. $= \frac{1}{3}$, and tangent of corresponding arc is 9 times arc; also cos. cor. being $\frac{1}{2}$, tangent of corresponding or *relative* arc $= 4$ arc, as we have seen above. In like manner taking for *correlate* arc the arc $45°$, its cos. $= \frac{1}{\sqrt{2}}$, therefore $\cos.^2 = \frac{1}{2}$, consequently, the tangent of *relative* arc is double that arc. Thus, we find arc $45°$ is the *correlate* of that arc whose tangent is *double* the arc; which may be found by the equation

$a = t - \frac{t^3}{3} + \frac{t^5}{5} - \frac{t^7}{7}$ &c., for here $a = \frac{t}{2}$, and substituting this value,

$\frac{t}{2} = t - \frac{t^3}{3} + \frac{t^5}{5} - \frac{t^7}{7}$, &c., $\therefore \frac{1}{2} = 1 - \frac{t^2}{3} + \frac{t^4}{5} - \frac{t^6}{7}$, &c.; therefore, $\frac{1}{2} = \frac{t^2}{3} - \frac{t^4}{5}$ $+ \frac{t^6}{7}$, &c., whence, reverting the series, we find t = tangent arc 66° 52′.

This arc presents some interesting considerations in a geometrical point of view.

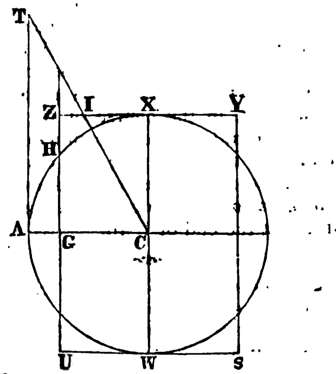
Since A T = 2 arc A D, the triangle A C T = 2 sector A D; therefore sector A D = triangular area A D T, contained by arc A D, tangent A T and side T D.



Draw from T another tangent T X meeting the circle in X, then arc A X = 2 A D = tangent A T or A X, and the plano-spherical equilateral triangle contained by the tangents A T, X T, and the included circular arc A X, (which is equal to either of them,) is equal to the sector A C X.

A rectangular area equal to area of the circle might perhaps readily be found thus: draw the radius C X at right angles to the radius A C; at X draw the tangent X Z = length of arc 45°; also in the contrary direction, X Y = length of arc 45°; produce X C till it meets the circle in W, and through W draw the tangent U W S, U W, and S W, being both made equal length of arc 45°, join X U and Y S, and the rectangle Z Y S U = area of circle.

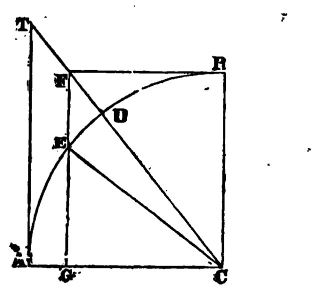
It is evident that here the inset A E G equals the offset Z X E; taking then the arc A E for a *correlate*, find its *relative* arc A D, draw its tangent A T, also secant C T, cutting Z X in I, produce E G till it meets secant in F, then the offset F E D = inset A E G, therefore offset Z X E = offset F E D; therefore the triangle Z F I = the triangular area I X D. Now the triangle I X C : triangle Z F I : : I X² : Z I²;



also the triangle I X C : triangular area I X D : : I X : I X − arc X D; therefore I X : Z I : : Z I : I X − arc X D; but Z X = arc 45°, therefore tangent of arc X D, arc of 45° − tangent of arc X D, and tangent of arc X D − arc X D, are in *continued* proportion.

As the cos. G C here = length of arc 45°, the arc A E = 38° 15′ 26″ 40‴, whose cosine = ·7853982.

It might be interesting to determine the arc A E, through whose extremity the side of the square (equal to the area of the circle) is drawn.



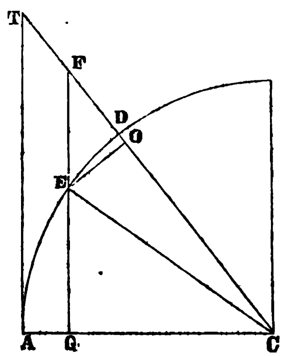
G C cosine of arc A E = $\sqrt{\cdot 7853982}$ = ·8862269; therefore,

Arc A E = 27° 35′ 10″ 22‴,
which will be approximated to by taking

$\frac{1}{2}$ arc of 45°	=	22° 30′
$\frac{1}{5}$ of this, or $\frac{1}{20}$ of 90°, which can be found as being $\frac{1}{16}$ arc of pentagon	=	4° 30′
$\frac{1}{8}$ of this	=	33′ 45″
$\frac{1}{32}$ of this	=	1′ 3″ 17‴
$\frac{1}{4}$ of this	=	15″ 49‴
$\frac{1}{4}$ of this	=	3″ 57‴
$\frac{1}{2}$ of this	=	1″ 58‴
$\frac{1}{8}$ of this	=	14‴
$\frac{1}{2}$ of this	=	7‴
		27° 35′ 10″ 22‴

So that the arc A E will be $\frac{893507}{1310720}$ of arc of 45°, or $\frac{893507}{2621440}$ of quadrant, or $\frac{893507}{10485760}$ of circumference.

We shall be much assisted in finding *correlate* arcs, and *vice versa* by the Table of the Areas of Circular Segments. For the area A G E is half of the circular segment whose height is A G, and, letting fall on C D the perpendicular E O, the area D E O is half of the circular segment whose height is D O;



but the area E A G = triangular area F E D; also the triangle F O E = triangular area F E D + the area D E O; therefore the triangle F O E = area E A G + area D E O, and doubling both sides F O × O E = area of circular segment, whose height is A G + area of circular segment whose height is D O.

Therefore radius A C being unity, $E O^2 \times A T$ = area of circular segment whose height is A G + area of circular segment whose height is D O; therefore, area of circular segment whose height is *versed sine* of *correlate* = sin.^{2} (arc − *corr.*) × tangent arc − area of circular segment whose height is versed sin. (arc − *corr.*)

Thinking these suggestions might prove interesting to the readers of your popular Magazine, as offering somewhat of a new field for investigation, I throw them out for their consideration.

I am, Sir, your obedient servant,

WILLIAM S. V. SANKEY, M.A.

IMPORTANT IMPROVEMENT IN DRESSING THE AURIFEROUS PYRITES OF NEW GRANADA, ETC.

The great loss which has ever been sustained in dressing the iron pyrites containing gold, in Colombia and New Granada, has long been felt; for many years have the directors of these companies had their attention turned to the subject, and numerous experiments made by scientific men, with only partial success. When the natives worked these mines, the total loss on the gold contained in the ore per assay was 75 per cent.; the loss to the companies, in 1841, was 58$\frac{3}{4}$ per cent.; in 1842, 51 per cent.—while last year the loss was only 49$\frac{1}{4}$ per cent. Could, however, this, or nearly the whole of this, be recovered, it would add so much to the gains, deducting the trifling expense of extraction. In a former Number (April 6) we noticed that Mr. Evan Hopkins, C.E., F.G.S., who had been several years in Colombia, but who came to England in 1842, had since been employed most strenuously in following up this interesting and important subject, and had at length succeeded in the construction of a dressing-machine which answered his most sanguine expectations. One was eretced in London, and, to the satisfaction of all who witnessed its operation, completely separated the whole, as per assay, of the precious metals from the ores in which they were contained.

The directors, we believe, immediately entered into an arrangement with Mr. Hopkins to proceed to New Granada, for the purpose of erecting these machines, and fully testing them on a large scale, and so satisfied is he of their efficiency, that he has, in his agreement, made his remuneration to depend on his success. He left England in the West India steam-packet, on the 2nd April, and advices having been received of his safe arrival in the West Indies, we trust soon to hear of the most gratifying results from his labours; and from Mr. Hopkins's well known mechanical abilities, as well as his geological and mining experience, there is every hope that the effects of these experiments will be of a most important character to the shareholders, as, should it even not effect the entire saving of the present loss, in whatever degree it may diminish that loss will be so much gain to the company.—*Mining Journal.*

Amongst the many useful inventions of ancient and modern times, perhaps few are of greater value to society than a bridge. It is of very little consequence whether the fallen tree across a stream, which was used by the ancients, first suggested the value of a bridge or not; but it is true that the same method is now very commonly used, even in railways, for crossing roads and rivers. However, in the advancement of civilisation and increase of knowledge, it was discovered that stones, cast-iron, timber, or any hard substances, leaning against each other, would answer the same purpose; and this, at the present time, is the fundamental principle of the universal compression bridge, which, it is true, has answered to a certain extent, but it has been at a most expensive rate. The suspension bridge, it appears, is as ancient as the stone bridge, and has been more extensively adopted by some nations; but its introduction into Great Britain is of recent date, notwithstanding which it has here already, as well as in other countries, been carried to many times greater lengths than it was possible to extend the compression principle, for many a broad river and deep ravine has been crossed with invariable success by this means, which could not have been accomplished by any other. The Menai, the Montrose, Friborg, Hammersmith, Shoreham, and Cubsac bridges, are a few instances of it. The Cubsac bridge, between Bordeaux and Libourne, in France, is the largest and most elegant structure of the kind. It consists of 1771 feet 3 inches of suspended road, 23 feet wide, which, with the viaduct of stone arches at each extremity, makes the total length of the bridge 5021 feet 3 inches, and it is 91 feet above low-water mark; the pillars upon which the chains are supported are of moulded cast-iron, of elegant design. This fine structure was completed in one year, in the midst of a multitude of engineering difficulties. Now the fact of so many great works on suspension having been so easily achieved, in every way proves the extraordinary power of this principle; which, in truth, is an easy position, tending only to maintain right powerful lines, and in every respect the reverse of the compression principle.

The adoption of the suspension principle, in the construction of bridges, is now becoming very general in most countries, but more especially in France, in consequence of its great capabilities and economy, and it would long since have been universal but for the great tendency of such bridges to vibrate, undulate, &c. At the same time, the compression principle has the same tendency to motion; but timber, stone, and cast-iron bridges being more massive, and of less length, the undulation caused by a passing load over them is less perceptible. These objections, however, are now completely obviated by Mr. Dredge's invention, the very nature of which is economy, stability, and facility of construction; in truth, so much so, that our widest rivers can now be spanned for all purposes at a comparatively little cost, which must lead to the erection of many useful bridges now little thought of, to the great advantage of mankind. Furthermore, the advantages of this principle in bridges, viaducts, and piers, are, a level inflexible roadway, and but little obstruction to rivers and navigation; a removal of all tension from the centre of the suspension arch, and all pressure from the key of the compression bridge; also, on the smallest scale, more than twice the power with the same material, and a saving of 1865 tons of iron out of 1935 tons in the chains of such a bridge as the Menai, with still greater advantages in larger bridges. This system of construction is a combination of tie and prop, like the mechanics of the animal and vegetable creation; but totally unlike the common system of construction, which is all tie in the suspension bridge, and all prop in the compression bridge. The former is therefore sustained by the lowest point of the arch, and the latter by the key-stone, which is like (in principle) a ship's mast reversed, sustaining itself and load on the smallest end; hence, bridges are expensive and of very limited power.

Connected with this important subject, and extraordinary as the contrast is in the two systems, there is also, in point of economy and power, a much greater contrast, if possible, betwixt the suspension and compression principles, which is certainly deserving great attention.

Indeed the fact is so clear and so easily demonstrable, that every one must see it the instant it is pointed out to him. The simple pendulum of a clock performs its office easily by suspension, which could not be done with the same economy in any other way. A piece of wire of any size and length would make a strong tie, but as a prop it would be powerless; or the same would easily make a suspension bow, but not a compression arch. Again, take a bar of iron of two tons weight and a thousand feet in length, it would sustain in a perpendicular position ten tons; but a compression tower of that height, equal to sustain the same weight, would require in its construction, were it possible to erect it, more than a hundred thousand times the weight of iron, and yet a suspension line of that length is not one-fortieth what has already been accomplished, and still greater lengths are obtainable. The longest artificial compression line in Great Britain is about 500 feet. If to these, and innumerable other proofs which could be easily adduced, it be added, that a bar of best iron, of an inch area at the base, would sustain itself on suspension nearly 60,000 feet in length, that the same would not sustain itself 40 feet in the very best position of compression; and further, that the grand power of all nature is tension or lift, then, as reference can be made to no higher school for instruction, there surely can be no earthly valid objection advanced why the same powerful principle should not be maintained universally in the construction of bridges.

Mr. Dredge has constructed fourteen bridges, many of them of large dimensions, and in use nearly eight years for the heaviest traffic, which is a test of experience, of the easy applicability of one of the most economical and powerful principles in mechanics to the construction of bridges. The principle was first adopted in Bath, by the Victoria Bridge Company; afterwards by the Government, in the Regent's Park, London; by Sir James Colquhoun, bart., over the Leven, in Scotland; G. S. Harcourt, esq., at Wraysbury, Bucks; H. Miller, esq., Frome; the River Lea Navigation Trustees; and in Calcutta, by the Government of India.

K. K.

LIGHTNING CONDUCTOR AT THE NEW ROYAL EXCHANGE.

Sir,—On a recent visit to the New Royal Exchange, I noticed an uninsulated copper rod, which has been set up against the tower of that edifice, as a *lightning conductor*. The conductor itself stands out a few inches from the wall, but is in immediate connexion with it at intervals by means of copper arms or brackets, by which it is supported, these being let into the stonework. This conductor is said to have been put up under the direction and superintendence of an electrician of some celebrity, who is an occasional contributor to your pages, but of this I entertain some doubt. When myself consulted, as to the best method of applying lightning conductors to buildings, I have laid great stress upon the advantages of perfect *insulation* from the building, and have given directions for the purpose calculated fully to effect that object. Not being very deeply versed in electrical science, it has occurred to me that I may probably be mistaken as to the necessity for, or advantages of *insulation*. I am aware that in the case of shipping, the conductors are not insulated, being merely let into the masts, but this is a choice of evils, and the exception rather than the rule. In the case of terrestrial buildings no such necessity exists, perfect insulation being easily accomplished.

Lightning conductors have been objected to, as likely to produce the very calamities they are intended to prevent, by attracting the electric fluid to buildings, over which it would otherwise have passed harmlessly. The reply to this has been, that, if the conductor present a sufficient surface to convey the fluid to the earth, and is properly insulated from the building, danger will in every case be averted.

The conductor at the New Royal Exchange may be large enough to ensure safety, although the conducting power being proportioned to the surface, and not to the mass, a copper tube of similar dimensions would have given nearly twice the surface, and therefore twice the conducting power. The conductor not being insulated, however, it seems to me that the tower is in more imminent peril from the presence of the conductor, than it would be if that appendage were away; its attracting power is unques-

tionable—its power of safe conduction doubtful.

I should be sorry to see this fine building injured by "celestial fires," and throw out these remarks for the attention of those parties who are more immediately interested in its preservation. Should I be in error, I shall be grateful to any of your correspondents who will set me right in the matter.

Remaining yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington,
August 24, 1844.

THE FRENCH MIS-ANGLO-MANIA.

The desperate propensity of our French neighbours to contest those honours which all the rest of the world is intent on rendering to England, is, so far as the arts and sciences are concerned, an old affair; as old, at least, as their discovery that the steam-engine and steam navigation were the offspring of French genius and enterprize, and much older, therefore, than the Joinville brochure and bombardment which are now threatening to set us all by the ears. It is with no surprise, therefore, though with rather more than the usual degree of merriment, that we read in the *Moniteur Industriel* the following remarks on our latest scientific achievement—the atmospheric railway.

"Messrs. Clegg and Samuda are *not* the authors of the idea of atmospheric propulsion; *the idea was Papin's, and consequently French.* Neither did they originate the first project for its practical application; the author of it was *the Danish engineer, Medhurst;* they did not even make the first experiment—it was Vallance. What really belongs to Messrs. Clegg and Samuda, *beyond the honour of having realized the first atmospheric iron railway*, is the longitudinal valve, and the resealing of it with a mixture of wax and tallow; the specification of the patent of these gentlemen establishes this incontestably; they claim nothing more. When, therefore, the invention of Messrs. Clegg and Samuda is spoken of, we must understand by it, not atmospheric propulsion itself, which does not belong to them, and which they do not claim as their property, but their manner of procuring that propulsion by means of their valve. The atmospheric system as applied in Ireland *has really nothing English in it*, except the longitudinal valve of Messrs. Clegg and Samuda."

How gratifying it must be to the sensible brawlers of "Ireland for the Irish," to be thus assured, on so respectable and impartial an authority, that there is "*really nothing English*"—save a bit of a hinge, and a trifle of wax and tallow —in that most remarkable of all their public works, the Dalkey Atmospheric Railway! A Frenchman furnished the crude idea, a Dane suggested how it might be worked out, and one Vallance (of whom we wonder the writer did not observe that, judging from his name, he is most probably either a Spaniard or a Kerry Irishman), made the first experiment. The paltry Sassenachs of England but furnished what any one else could have furnished (but *did not*) the hinge (on which the entire success of the affair *hinged*), and a little wax and tallow (with a small modicum of hard coin omitted to be mentioned, and not worth mentioning)—the grease, as it were, to the carriage wheels. The Frenchman of the crude idea we know of; and we know also that in all his speculations on vacuum power he never approached within a thousand miles of "atmospheric *propulsion*," in the sense in which the term is used by the writer in the *Moniteur;* we are aware, too, of all that Mr. Vallance effected, and do not think the less of the claims of Messrs. Clegg and Samuda; but Medhurst *the Dane*—who the deuce is he? One Medhurst there was who had something to do with atmospheric propulsion; but *that Medhurst* was a genuine, dunderheaded, unimaginative, uninventive Englishman. Who *the Dane* of the same name could be, we were wholly at a loss to conjecture; and turning at last in despair to the pamphlet of the English Medhurst for some clue to the mystery, lo and behold, it stood at once revealed before us. Medhurst's London habitat was—*Denmark Co. Soho.* So—ho!!! "*Denmark Co.*," our sagacious Frenchman has interpreted to mean, of the *country* of Denmark, or perhaps *court* of Denmark; and, enchanted with the capital opportunity which this new reading afforded him of plucking another feather from John Bull's cap of maintenance, and at the same time *illustrating* and *dignifying* his own country's blind jealousy of everything English, he forthwith adds, "l' ingénieur *Danois* Medhurst" to the

list of illustrious foreigners to whom "perfidious Albion" is mainly indebted for her power and renown! We wish our friends of the repeal button too well to bid them joy of such an ally. We respect them too highly to imagine for a moment that they can be otherwise disposed, than to laugh with us, at this comical display of the mis-Anglo-mania with which our Gallic neighbours are so unhappily afflicted.

THAMES STEAMERS.

Sir,—Glancing over the advertisements of the *Times* this morning, the following, under the head of steam to Margate and Ramsgate, &c., caught my eye:—"The *Eclipse* generally arrives at Margate ½ to ¾ of an hour before the *Prince of Wales*, which leaves at the same time, and Ramsgate half to one hour before the steamer that leaves half an hour before." Now, no one takes a greater interest in a fast Thames steamer than I do, and past Numbers of your Magazine, I think, will bear me out here; but I hate puffing, and whenever I see an advertisement of this kind, I always like to examine the merits of the puff pretty closely. One thing must be certain, and that is, that if the above statement be true, the steam in the boilers of the Messrs. Napier's crack vessel, must puff with a vengeance, to make her outstrip the *Prince*, which last year was greatly her superior in speed, and which I know, from repeated trials this season with new vessels, has not in the least fallen off. Suspicions are often unreasonable, but unless suspicions are satisfactorily met, suspicions will always exist; and the secrecy that is maintained with regard to the pressure employed in the boilers of this and other vessels, has caused many to suspect, when they see such great speed, that *all* is not right—and that the pressure is at times unduly increased, in order to pass or overtake rival vessels. Such may not be the case—I hope it may not, I am sure—but never, that I know, have the above suspicions been completely removed—although rife enough. The Messrs. Napier have, I admit, been very successful in obtaining a great rate of speed for their vessels; but, somehow or other, that rate of speed has been maintained hitherto only by fits and starts. The steamer, that one day went flying past every thing, has the next been known to fall into the rear of some, but yesterday, despised production of the old school. That this, and numerous "total break downs" have occurred not once or twice, but repeatedly, I need only appeal to those who are conversant with the Thames steamers. Granting that the *Eclipse* and *Isle of Thanet* surpass all other steamers in speed, I would yet ask, if there is one single qualification, save and except this, by which they may be favourably compared with their many rivals? Let us take only the steamers that are plying on the Margate and Ramsgate station, say the best, viz., the *Prince of Wales*, the *Little Western*, the *Herne*, and *City of Canterbury*, and compare their duties and performances with those of the *Eclipse* and *Isle of Thanet* for any three months, say, from June 1st to September 1st; let the *pressure*, daily consumption, power, and tonnage of each be accurately noted down, also the number of miles run by each during that period, also the days and hours they were under steam, with the time spent in repairs and cost of the same. Now if we could obtain such returns as these, Mr. Editor, and if they were found to place Mr. Napier's vessels among the A 1's in every respect—why then, I say, there would be more room for puffing than I think at present exists.

I am, yours, very truly,
NAUTICUS.

Gracechurch-street, August 22, 1844.

THE ROYAL STEAM NAVY.

In the month of September, 1841, there were 68 steam-vessels of all classes in commission. On July 1, 1844, there were 89. In September, 1841, there were 15 steam-vessels in ordinary; in July last, there were 12. In 1841, we had 8 on the stocks; now, we have building 26. The amount of horse-power in 1841 and 1844 is as follows:—

	Sept., 1841.	July, 1844.
In commission	9329	13,941
In ordinary	2565	3167
Building	1897	9526
	13,791	26,634

The steam-vessels building are these:—Terrible, 800 horse-power; Avenger, 650; Dragon, 560; Vulcan (iron), 556; Centaur, 540; Sphynx, 500; Samson, 450; Conflict, 450; Dauntless, 450; Desperate, 450 Niger, 450; Odin, 450; Gladiator, 430

Bulldog, 420; Scourge, 420; Inflexible, 420; Amphion (auxiliary), 300; Trident, 200; Spitfire, 130; and six dispatch boats, 900.

The largest, the Terrible, is one-third built; the Amphion, 36, is in a very forward state, as are the Dragon, Gladiator, Samson, Inflexible, Scourge, Trident, Vulcan, the six small dispatch boats, and the Spitfire. The Bulldog has her keel laid down; the Sphynx is laid down; the Centaur has her timbers prepared, and the frame of the Avenger is being cut out. The timbers of the Conflict, Dauntless, Desperate, Niger and Odin, are partly prepared and in course of preparation.

The following are the dimensions, &c. of the *Terrible*:—Length between perpendiculars 226 ft., keel for tonnage, 196ft. 10½ in.; extreme breadth, 42 ft.; depth of hold, 27 ft.; engine-room, length, 75 ft., width, 38 feet, depth, 27 ft.; diameter of paddle-wheels, 34 ft. by 13 ft.; diameter of cylinder, 6 ft.; power of engines, 800 horse; weight of engines, 500 tons; coal boxes to hold 800 tons of coals; burthen 1847 tons; cost of boilers and engines complete, 40,250*l*.

Besides these vessels there is one now building for Government by the Messrs. Laird, of Birkenhead, which will be the largest, next to the *landlocked* Great Britain, ever constructed. She will be of 1,400 tons burden, and her engines will consist of two 560 horses power. "This vessel," says the *Liverpool Advertiser*, "has been commenced upon the requisition of the Admiralty; but the particular service she is intended for is at present a secret. She will be supplied with heavy guns, so as to take her 'own part,' whenever it may be necessary."

MEMOIR ON THE PREPARATION OF ARTIFICIAL YEAST—BY DR. FOWNES.

It often becomes a matter of great practical importance to have it in our power to excite the vinous fermentation under circumstances in which ordinary yeast cannot be obtained. In making bread, for example, although the use of yeast may be avoided by employing what is called "leaven," or dough which has already become sour, and partly putrefied by spontaneous change—a practice which has been followed from the most remote antiquity, and is still occasionally in use; the bread so made is always to be distinguished by a peculiar sour and nauseous taste and smell, and can never bear comparison with that fermented by yeast.

The object of the present notice is to point out a method by which yeast of the most unexceptionable quality can be artificially produced at will. I am aware that some substitute for ordinary ferment in brewing has long been known to certain persons, who go about the country and impart their secret to those who are willing to purchase it; of the nature of this preparation I am ignorant, and a reference to systematic chemical works will suffice to show that whatever it be it has never been made public.

On turning to Berzelius, it will be found stated,* that although the reproduction, as it were, of yeast, the conversion of a small into a large quantity, is a very easy thing, yet to produce that substance from the beginning is very difficult. He describes a process for this purpose on the authority of Dr. Henry, and which consists in taking a strong infusion of malt, saturating it with carbonic acid, and then exposing it for some days to the proper fermenting temperature, when a small quantity of yeast is gradually formed and deposited, which may, by various contrivances, be made to give origin to a larger. I shall have occasion to notice presently the behaviour of a malt infusion when left to itself at a temperature of 70° or 80° Fahr., for some time, and to show that the addition of carbonic acid is wholly unnecessary.

The principle of induced chemical action, which Liebig has assumed to explain a great number of those extraordinary phenomena to which Berzelius gave the term "Catalysis," and which principle has been so fully confirmed, and even perhaps extended by the late valuable researches of MM. Boutron and Frémy, on the formation of lactic acid, serves to solve this difficulty, as it will doubtless many others of far greater magnitude and importance. It has been shown that "the kind of chemical change going on in the decomposing azotized body of ferment determines the kind of decomposition which shall occur in the neutral ternary substance, subject to its influence;" that diastase, for example, according to its peculiar condition, whether fresh from the germinated grain, slightly putrefied, or in a still more advanced state of that change, possesses the singular power, in the first case, of changing starch into dextrin, and ultimately into grape sugar; in the second, of causing the conversion of sugar into lactic acid; and in the third and last of exciting the vinous fermentation.

Now if common wheaten flour be mixed with water to a thick paste, and exposed, slightly covered, to spontaneous change in a moderately warm place, it will be observed to run through a series of changes which seem very closely to resemble those described by MM. Boutron and Frémy, in the case of diastase.

* Lehrbuch, vol. viii., p. 89, foot note, third edition.

About the third day of such exposure it begins to emit a little gas, and to exhale an exceedingly disagreeable sour odour, much like that of stale milk; after the lapse of some time this smell disappears, or changes in character, the gas evolved is greatly increased, and is accompanied by a very distinct, and somewhat agreeable vinous odour; this will happen about the sixth or seventh day, and the substance is then in a state to excite the alcoholic fermentation.

A quantity of brewers' wort is next to be prepared in the usual manner, by boiling with hops, and when cooled to 90° or 100°, the decomposed dough before described, after being thoroughly mixed with a little tepid water, is added to it, and the temperature kept up by placing the vessel in a warm situation. After the lapse of a few hours, active fermentation commences, abundance of carbonic acid, having its usual pungent smell, is disengaged, and when the action is complete, and the liquid clear, a large quantity of excellent yeast is found at the bottom well adapted to all purposes to which that substance is applied.

In one experiment the following materials were used:—a small handful of ordinary wheat flour was made into thick paste with cold water, covered with paper, and left seven days on the mantel-shelf of a room where a fire was kept all day, being occasionally stirred; at the end of that period three quarts of malt were mashed with about two gallons of water, the infusion boiled with the proper quantity of hops, and when sufficiently cooled, the ferment added. The results of the experiment were a quantity of beer, not very strong it is true, but quite free from any unpleasant taste, and at least a pint of thick barm, which proved perfectly good for making bread.

It appears to me that this simple plan would enable distant residents in the country and settlers in the colonies to enjoy the luxury of good bread when a little malt could be got, a very easy home manufacture from grain of any kind; the hops might probably be omitted when the yeast alone was the object.

A moderately strong infusion of malt which has not been boiled, suffered to stand in a warm place for some days, speedily becomes sour and turbid, and begins to evolve gas; this change rapidly progresses, carbonic acid is given out plentifully, and a deposit of thick insoluble whitish matter formed, which readily excites fermentation in a dilute solution of sugar; the supernatant liquid contains alcohol, acetic acid, and, I believe, lactic acid.

When wort, which has been boiled and hopped, is set aside to decompose spontaneously, the change it undergoes appears to depend very much upon its strength. When weak, three or four days elapse before anything is noticed; a scum then collects upon the surface, and a brown flocculent substance is thrown down, which is incapable of exciting fermentation in a solution of sugar, while the liquid gives off a flat offensive smell. If the infusion experimented on be stronger, then the change is different; the liquid becomes turbid from the separation of a yellowish adhesive substance, a good deal of gas is very slowly emitted, alcohol is formed, and the deposit at the bottom of the vessel proves a pretty active ferment to sugar. The acidity of the liquid is but trifling, and its smell is somewhat disagreeable. These differences in the behaviour of boiled wort may also depend upon the quantity of hops added, and the length of time during which the ebullition had been continued.

The effect produced in a spontaneously fermentable liquid by vegetable acids or acid salts, such as cream of tartar, is a curious subject of inquiry. From an experiment made upon some wort, it appeared not improbable that the result of such addition showed an interference in the formation of lactic acid. We know that when the juice of grapes, or currants and gooseberries, is exposed to the air, the vinous fermentation is set up apparently at once; whereas, in an unboiled infusion of malt, which is destitute of these substances, lactic acid seems to be first formed, although ultimately the two fermentations go on together.

I stated, when speaking of the spontaneous decomposition of wheaten dough, that an acid state preceded that in which it became an alcoholic ferment, and if in this condition it be mixed with a dilute solution of common sugar, and the whole kept warm for several days, it furnishes a sour liquid which is rich in lactic acid, and from which white crystallized lactate of zink is easily prepared. There is a tendency in the liquid to run into the alcoholic fermentation, and to produce vinegar by a subsequent change, but still the quantity of lactic acid so formed is very considerable.

Common wheat gluten, then, in its mode of decomposition strikingly resembles diastase; like that substance it runs in succession through two different dynamic conditions; it is successively a lactic acid and an alcohol ferment. Is it too much to expect that it might, by proper means, be detected in a third condition, namely, as a "sugar ferment," like diastose itself in the state in which it exists in malt? Is it not possible that diastase, as a definite proximate principle, has no more existence than yeast; that its powers are purely dynamic, and that it is, in short, nothing more than the gluten of the seed in one of its earliest stages of decomposition?

This is an interesting enquiry, but its prosecution will be somewhat difficult, from the rapidity with which these changes succeed each other. It must be remembered that no one has yet succeeded in getting diastase in a state fit for analysis.—*Mem. Lond. Chem. Soc.*

COBBY'S APPARATUS FOR CAUSING THE PADDLE-WHEELS OF A STEAM VESSEL TO REVOLVE IN A CONTRARY DIRECTION TO EACH OTHER AT ONE TIME, AND THEREBY TO TURN THE VESSEL ROUND.

(Registered under the Act for Protection of Designs for Articles of Utility.)

Fig. 1.

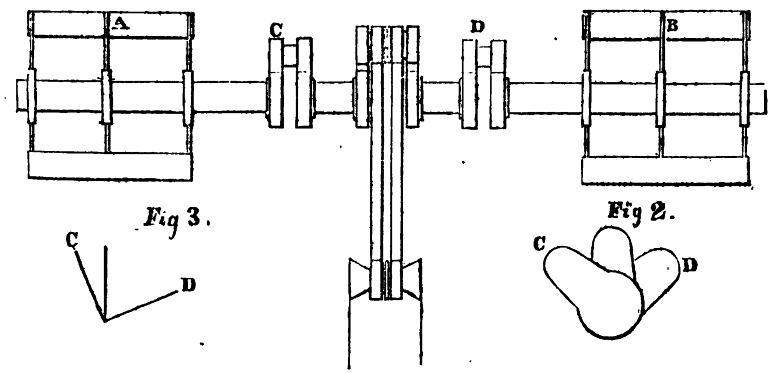


Fig 3.

Fig 2.

Sir,—I enclose a description of a plan for causing the paddle-wheels of a steam vessel to revolve in a contrary direction to each other, and I shall feel obliged by your inserting it in your valuable Magazine. The utility of this plan may be judged of from the following extract from the *Times*:—

"*Loss of Her Majesty's ship Gorgon.*—The following extract of a letter from an officer on board will be read with interest:—'Monte Video (on shore), May 24.—I write at once to inform you of the particulars of the loss of the *Gorgon*, lest you may be unduly alarmed for our safety. On the 14th it blew rather hard; it soon began to blow harder, and we veered a little. The wind still growing higher, we sent down our yards and top-masts. The next day we began to drive, so we let go our small bowers, and veered. A little while after we parted it, and slipped the best bower, intending to go to sea, but we found it impossible to do so, as we could not get her head to the water. So we got well up to windward, and let go our sheet anchor and veered on it. We parted that after a little time. We then let go the stream, and backed with the largest kedge; but we drove still, and went on shore, and now we are high and dry on the sand. With our four boilers, and full power on the engines, we could not put out to sea, but if we once had had our head to the water we should have been all right.'"

I think the opinion of the officer, who writes this letter, would be, that if the *Gorgon* had been fitted with my plan, she would not have been lost.

I remain, Sir,
Your obedient servant,
Henry Cobby.

Hull, August 19, 1844.

Description.

A and B are the two paddle-wheels, and C D two cranks connected to the main shafts and engines. When the engines are started, the paddle-wheel A is moved in the same direction as the crank C (figure 2), towards the crank D; and the paddle-wheel B in the same direction as the crank D, towards the crank C. To reverse these motions, the paddle-wheel A is made to move in the same direction as the crank C, towards the point E; and the paddle-wheel B to move in the same direction as the crank D, towards the point E. The intermediate cranks may be placed at a different point as in figure 3, which will make the engines independent of the momentum required when placed as in figure 2.

MEMOIR ON THE FILTRATION OF WATER ON A LARGE SCALE, AND ON THE PROPERTIES OF MAURRAS'S PATENT FILTER. BY B. G. SLOPER, ESQ. ADDRESSED TO THE COMMISSIONERS APPOINTED TO ENQUIRE INTO THE HEALTH OF TOWNS.

We have reason to be surprised that, on a subject of so much importance as the purification of water by means of filtration, its theory has been so little understood; that, in apparently so simple a mechanical operation, so many errors have been committed, and such large sums of money wasted in our own and other countries. This very appearance of simplicity has probably been the cause. It has led men to conceive systems—to adopt them without resorting to the safe guide of observation and experiment. In fact, hundreds of thousands have been thrown away, and may so again, if I may judge from the result of my own experience, and the ideas respecting filtration which I know to be entertained by many who are otherwise men of science and talented practical engineers. Only a short time back, a railway engineer described to me a filter he was erecting, which, for result, would give him his filtered water about as clear as the dirty liquid he was proposing to clarify. Even an eminent hydraulic engineer, whose life has been almost devoted to the subject, maintains that there is a chemical action, a "something more than a straining action," in filtration. Having undertaken the introduction into this country of Mr. Maurras's filter, I have availed myself of his experience, studied the subject intimately, examined most of the patented and other systems which, for the last half-century have been brought before the public; and, as the subject is one to which the Board have devoted much time and attention, I hope I shall be allowed to enter at some length into the subject.

Filtration is a fine straining, a retaining of the minute solid particles of matter suspended in water, by the means of a porous filtering material.

This is easily understood; but there are conditions which must all be fulfilled before a good and constant filtration can be effected.

There are two kinds of filtration: one which is effected by the surface of the filtering material; the second, in which the mass of the filtering material operates, the retention of the solid particles of matter. The chemist who uses filtering-paper when, for example, he filters rain-water, which contains only minute impurities floating in the atmosphere, finds that, after the water has freely filtered for a certain time, the quantity gradually diminishes, and at last flows extremely slow; and yet there is hardly an appreciable ponderable quantity of impure matter added to the weight of the paper. Here we have a filter which acts almost entirely by its surface, and as soon as the minute pores exposed on that surface are closed by the light particles of solid matter, filtration ceases. On the other hand, when we employ sand as a filtering material, a certain thickness of sand becomes necessary to be used. The grains of sand are of different diameters and dimensions, and present such irregularities of surface that the intervening spaces or pores are necessarily of different diameters. The consequence is, that the minutest particles of the dirt to be arrested will traverse at various points the larger interstices at or near the surface, until arrested by the small pores of a less diameter than themselves at a certain depth from the surface. This is seen to be true on taking out a spadeful of sand from the surface of such filtering beds as those at Battersea, Chelsea, Stockport, &c. The dirt is seen to have penetrated some inches below the surface, gradually diminishing in quantity as it is distant from the surface. The quantity of water filtering gradually diminishes as the pores are filled up by fresh minute matter, until, like the paper filter of the chemist, filtration almost ceases by the obstruction of the porous mass, as far as is compatible with the forms both of the impurities and of the pores of the filter. Constant porosity is therefore the essential quality of a filtering material; and whether we look to nature on a large scale, to the artificial arrangement of filtering beds of sand in imitation of her, or to the compact instrument of the mechanical inventor, the constant porosity of the filtering sand, or other material, is the essential condition for the constancy of product in quantity.

The quality of the filtered water is dependent both on the minuteness of the impurities or solid matter to be strained from the water, and the diameters of the pores of the filtering material. When the pores or intervals between the material particles of the filtering substance are less than the smallest diameter of the solid impurities, or than the diameters which the elastic impurities suspended in the water are capable of assuming, they will be retained, and *vice versa*.

The next condition for an efficient filtering material is, that it should not be of a nature to communicate impurity of any kind to the water. Nature herself may fail in this way. All the fresh water presented for our use has its first source in the rain, which

descends almost pure water from the clouds, and only containing the light dust which floats in the atmosphere, and a certain quantity of its gases. As it filters through the various soils, it dissolves a portion of the soluble salts it comes in contact with, either by reason of its own solvent power, or by the action of the carbonic acid it contains or has absorbed in its passage; and when it appears on the earth's surface again as the crystal spring, its real quality depends on the nature and extent of the various strata of earths and rocks it has traversed; its brightness and freshness are not proofs of its purity, or of its fitness to satisfy the wants of man. It sometimes rises so charged with sulphates and carbonates of lime, magnesia, &c., that it is almost poisonous, and very generally contains so large a proportion of carbonate of lime as to be unwholesome and unfit for all domestic and most other purposes. Its freshness and tempting brilliancy causes it to be generally sought after, but seldom from its really good quality. So, in all artificial filters, the filtering material should be unexceptionable. It is not sufficient only that it should be porous; its chemical nature should be such that it cannot change under long continued moisture, decompose, ferment, or by mechanical rupture allow particles of its substance to pass away at any time with the filtered water. Several modern filters, which I will allude to presently, promised well for a time, but have been abandoned in consequence of their defect in this very important particular.

The next and last quality by which every practical system of filtration must be tested is its cost; and this, whether we simply avail ourselves of an advantageous locality, sink our shafts and run our tunnels in sand and rock, or construct artificial exposed sand filters of large dimensions, or manufacture our machines, will depend—1st, on the first cost; 2ndly, on the cost of filtration; and 3rdly, on the durability of the filter. It is with relation to these preceding principles or theory of filtration, that I will attempt to examine the principal means and systems for the purification of water by filtration on the large scale. I have entered perhaps at greater length into the theory of the art than may have appeared suitable to the practical character of the Board; but it was necessary, in order to point out in what the defects of existing systems of filtration consist.

Where nature filters water and produces springs, she has the advantage of unlimited surface. A large tract of country may be the superficial or subterranean surface contributing to the supply of a small spring; and even supposing that the pores of the filtering strata were not repeatedly opened by some particular natural causes which can be conceived, the quantity of spring water might continue to flow undiminished for centuries. The small quantity of water produced by springs, in proportion to the filtering surface, explains this; but where large quantities of water are required, the filtering surface must be renewed, or the quantity must fall off.

The first system I will examine is that in which man takes advantage of the particular disposition of the soil, and seems to have nothing to do but to dig below the level of the nearest river in order to obtain an abundance of filtered water. There can be no doubt that when a river runs through an extensive sand district, the locality invites the construction of a natural filter; but experience has not always justified the expectation entertained, either of the little cost, the excellence, or the durability of the system.

Toulouse, in France, is supplied with water from the Garonne, by a filter of this kind; which, notwithstanding its apparent simplicity, has cost from first to last 40,000*l.* in its construction, for the supply of filtered water to 50,000 inhabitants.

The experience we have of the Glasgow water-works, and the immense sums of money expended under the direction of skilful engineers, should induce caution before we decide in favour of this natural system of filtration, which is enticing from its imitation of nature and apparent simplicity. The most eminent men have lost sight of, or not understood, the true principles of filtration; they have not borne in mind that when water filters through sand, it deposits its solid impurities to a certain depth between the interstices of the sand; that if nature does not renew the filtering surface, man must; or that the very mass of sand, which was at first a porous filter, will become an impermeable earth, better calculated to furnish nourishment to vegetation than abundance of filtered water; that the closing of the pores of the filtering sand is directly as the proportional quantity of dirt held in the water, and the quantity of water filtered; and, consequently, that when we require from a natural filter constructed near or upon the banks of a river a perpetual and abundant supply of filtered water, the quantity will diminish, and ultimately fail, and the capital expended be wasted, if this first principle of filtration be not attended to. All natural filters must be more or less defective on this account. Their extent of filtering surface may allow of filtration for a period of time, but without it can be shown that there exists some natural or artificial means of renewing the porosity of the filter-

ing surface, the quantity of filtered water must at some time rapidly diminish in quantity, and finally fail. On this head I will state the results of some experiments made by Mr. Wickstead, C.E., upon sand filters some years back. A sand filter, which yielded at the rate of ten the first week, yielded nine the second week, only six the third week, and only two the fourth week; so that a large natural filter, which may render an abundance of water for a number of years, will after a time surprise the engineer by the rapid decrease of its product, and possibly its ultimate total obstruction. I dwell particularly on this, because one of the most essential requisites of a system of filtration is its certainty and permanency, as well as the means of extending the product of filtered water with the increased wants of a population, without the chance of a diminution or failure from any cause whatever. The best natural filter appears to be open to this objection. Another defect is, that there must always be uncertainty (in the first instance) in the quantity and even quality of the water, and consequently in the ultimate cost of construction. What has happened before is very likely to happen again. All the elements of supply being in the hands of nature, it is only more or less by guess that the engineer presumes on the result of his operation. He can calculate something of the cost of his plan, but very little on the certainty of the result; but as the cost depends on the result, the cost of obtaining a certain supply of water is necessarily uncertain. I believe the results of such operations have almost always disappointed expectations; they have always fallen short of calculation, and thus have led to much larger outlay than was at first contemplated. Examples of this are not wanting.

The next system of filtration which I will examine generally is that of extensive filtering beds, such as those of Battersea, Bury, Chelsea,* Stockport, &c. In this system beds of sand of considerable thickness rest on beds of gravel, &c. At intervals of time, from ten days or a fortnight, depending on the state of the dirty water, the water is run off, and the filth which has accumulated during filtration is scraped off with a certain thickness of the sand of the filtering bed. At longer intervals of time, the whole of the sand removed is replaced, generally once or twice a year. The principal faults of this system are, 1st, That it is costly; 2ndly, That the quality of the filtered water is defective. On the first head I cannot do better than refer to a Report of Mr. Wickstead, made in 1840, partly drawn from evidence given before a Committee of the House of Commons on the subject. The expense of filtration by the Chelsea filter he estimates as follows:—

	£	s.	d.
First cost, exclusive of land	11,700	0	0
Annual cost of raising water on filtering bed..........	800	0	0
Annual cost of cleansing and renewal................	800	0	0
Five per cent. interest on outlay of capital............	585	0	0
Annual cost, &c.	2,185	0	0

The quantity of water filtered was originally stated before the Committee to be 2,300,000 gallons daily. It is since stated to be 3,136,320 gallons, or 72 gallons per superficial foot of the filtering bed. The above outlay and annual charge is exclusive of cost of land, which in a populous district is a very costly item of first outlay. Thus I believe that the Chelsea Company have only lately purchased a piece of land adjoining their works, in anticipation of the necessity of extending them, for which they have paid 10,000*l.* On the second head, the quality of the water filtered,—it varies according to the state of the filtering bed. Immediately after the removal of the dirt, and about one inch of sand at each cleansing, the pores may be said to be open. About two feet depth of water only is then run on the filter, and as the filtration diminishes by the obstruction of the capillary passages, the depth of water is increased to augment the pressure. The filth then accumulating on the surface, becomes the filtering material—a compound of mineral, vegetable, and animal decaying matter, certainly not calculated, particularly in warm weather, to improve the chemical quality of the water. An examination of these waters, and their tendency to favour the production of vegetation, would lead to a conclusion that their quality was defective.

A modification of this system is that of Mr. Thoms, who arranges his bed in such a manner that he can obtain a return current of water upwards, and thus he proposes to cleanse his beds from the dirt retained. By this plan a less average pressure is to be exercised, and, consequently, the cost of pumping is diminished as well as the cost of cleansing; and as the last-named defect of the Chelsea filter, viz., that of filtering through an impure and contaminating filtering material at times, is obviated, the quality of the water should be improved.

It must not be thought, however, that the

* For a full description of the Chelsea method, see *Mech. Mag.* vol. xl., pp. 306, 327.

simple return of the current of water upwards will remove all the dirt from the filter, or prevent its gradually becoming choked so as to require the renewal of the surface at intervals. What I pointed out to Captain Denison and Professor Owen, relative to the operation of cleansing Maurras's filter at the New River Head, must equally be the case in Mr. Thoms's filter. We find that the return of the current of water, even under a pressure of 26 feet head, does not remove one-tenth part of the dirt. It requires violent agitation to dislodge and detach the filth from between the grains of sand. This necessity can be shown to demonstration at any time. The quantity of water required to cleanse in Mr. Thoms's system, and remove even the small quantity of dirt the simple reflux will carry with it, must be very considerable in proportion to the amount filtered. The large extent of filtering surface renders this inevitable. The first cost will not vary much from that of this system adopted at Chelsea, and where land is valuable from its particular locality, as at Chelsea, that item of expense is equally important. I cannot think that on the whole there is any economy in this system over that of Chelsea, in cleansing, and if established where the supply of water was limited, the large quantity which would be consumed for the purpose would be a great drawback on its utility. Its principal advantage appears to me to consist in the not employing the accumulated loose filth itself as a filtering material, and thus in securing a better quality of water, more free from the incipient germ of putrefaction and nascent vegetation than is adherent in the Chelsea system. As to the employment of vegetable and animal charcoals in filters on a large scale, I am surprised that it has ever been seriously recommended by persons who have reflected on the nature and extent of the chemical action of these substances. I find, however, that they have been proposed by more than one engineer, and therefore it is desirable to examine with what probability of successful application. Both vegetable and animal charcoal are worse than useless at all times, as far as their mechanical filtering power is concerned. I say worse than useless, because their brittleness and the uncertain division of their substance in consequence, render them variable in their filtering power, and not to be calculated upon. It is from their chemical action they are recommended. The chemical action of vegetable charcoal consists in its power of absorbing some of the gases in different proportions, according to their nature. To do this actively, and to the full extent of its power, the charcoal should be well and fresh burnt, and *dry*. When moist or wet this absorbent power is very much diminished. But as soon as vegetable charcoal has absorbed its quantum of the gases, its chemical action ceases, and it becomes inert as a chemical agent, and perfectly useless or less effective than the same volume of sand. It is important to understand this. It is an invaluable agent in removing the taint of an infected *pot au feu*, but for the purpose of disinfecting the water consumed by a population it is preposterous to conceive it. Perhaps it is better to meet these plans by figures. Suppose the plan applied to the Chelsea filter, by some ingenious contrivance, whereby the bed of charcoal could be removed when requisite; suppose the thickness of the charcoal bed to be 1 foot throughout. The solid contents of such a bed would be 43,560 cubic feet. The lowest price of rough charcoal at the large iron works is about 4*d.* per foot. For the purpose of filtration, the charcoal must be broken down, when it occupies only one half its volume. One filter bed would, therefore, require 87,120 cubic feet of charcoal, which at the low price of 4*d.* per foot gives 1,450*l.* The duplicate bed would require as much, making together 2,900*l.*, without any allowance for labour, &c. If the charcoal were productive of a permanent effect, this would not be an expensive material for the advantage intended to be derived from it; but when it is remembered that 3,000,000 gallons of water, containing their equivalent quantities of the gases of the atmosphere capable of saturating the absorbent power of the charcoal, are to pass through this charcoal daily, it must be evident that the very costly nature of that substance, even at my very low estimate, coupled with the fact of its rapid deterioration, and the final inertness in a short time of the chemical quality for which it is recommended, render it too costly an article to be employed in filtration of water for all purposes on a large scale. The case of animal charcoal is very much worse. The best animal charcoal only contains 10 per cent. of animal carbon. The other nine-tenths are principally phosphate and carbonate of lime, the first of which is soluble by the action of the carbonic acid held in the water. Its chemical property is to combine with vegetable colouring matter. Its cost would be enormous. It cannot be afforded by a manufacturer at less than 8*l.* per ton. One ton measures about 50 cubic feet. The stratum of one foot of animal charcoal would thus cost 7,000*l.*, and for the two filtering beds 14,000*l.* for the material alone. Its durability and power would be even less than that of vegetable charcoal. These schemes, therefore, for employing animal and vegeta-

ble charcoal as filtering materials on a large scale are deceptive. I am aware that they have been employed, but more for the name by some Companies than for any good the small quantity used could effect.

These are the principal systems which have been executed for the filtration of water, in presumed imitation of natural sand beds. But there are situations where, even supposing these systems were proved to be without defect, they would be inapplicable. I will refer to an example. The New River Company supply daily, it is stated, 12,000,000 gallons of water to their districts of the metropolis. At the rate of filtration of the Chelsea filter (and it must be remembered that the filters at Bury, Manchester, and Glasgow yield a much smaller supply, viz., that at Glasgow not filtering 30 gallons per superficial foot in 24 hours, whereas the Chelsea filter is said to give 72 gallons in that time), the filtering surface required to be in constant operation to pass the New River would be about four acres; a duplicate filter is necessary, as at Chelsea, one bed being cleansed while the other is filtering; therefore eight acres of filtering surface are absolutely necessary under the most favourable circumstances. But this only includes the surface of filtering sand; the slopes and intervals, engine-room, &c., would occupy half as much again, or four acres, making twelve acres in the case of constant filtration. But the New River Company state that, from the existing and necessary organization of their works, they could only filter during 12 hours instead of 24. If this be necessary, and no means could be suggested to remedy this inconvenience, which at once doubles all the cost of filtration, 24 acres of land would be required for a filtering establishment on this system at the New River Head. It is evidently inapplicable in such a situation. If it were to be established some miles from London, where land might be obtained, the cost of bringing the filtered water to London in a covered way or gigantic mains, would almost compensate for the difference in the value of land, &c.; and an alteration in the whole system of distribution of such a mass of water daily would be too considerable for any company to contemplate. These systems, with all their defects, are therefore not capable of being applied in such localities. Some more compact system could alone enable such a company to distribute filtered water to its tenants at any reasonable charge for the improvement.

To meet this want, several filtering machines have been contrived, intended to filter so abundantly, as to be susceptible of adoption by the Water Companies. I have examined formerly the nature of some 60 or 70 patents in this country and the continent, besides the inventions of many others who were fortunate enough not to throw away their money in publishing their inventions by the means of a patent. Of the few filters which have stood the test of even a few weeks' experiment, two inventions some time back seemed likely to rival one another, from the abundant product they yielded: these were the cotton filter and wool filter. Both have now, I believe, succumbed to the effect of their principal defect, and will be soon forgotten. They both failed from the same cause, the employment of improper filtering materials, which resisted for a time the destructive action of moisture, but ultimately submitted to the laws of their chemical nature, and imparted impurities of their own to the water they were intended to purify and render potable. The wool filter, or, as it was called by Mr. Wickstead, the French filter, had for its filtering material mill puff, which, being compressed, formed an excellent filtering material, as far as minute porosity was concerned. The inventor had sufficient influence to obtain a very favourable report from the French Academy of Medicine, and its adoption for the supply of some of the fountains of Paris. It is only within the last year that the defect which belongs to all vegetable and animal substances, as permanent filtering materials, has become sufficiently manifest to overcome the influence which was employed to obtain the adoption of the wool filter, and that it has been discontinued in the public establishments in Paris to which I have alluded.

To merit entire confidence, such confidence as would justify a public company in expending a considerable sum in the adoption of any system of filtration, I maintain that it should be based on the principles I have exposed, that a filter or filtering machine, natural or artificial, should be indestructible, as much so as the company's mains which lie along our streets; that the filtering material should be equally so, unalterable, imputrescent, under all circumstances of temperature and chemical influence to which it may be exposed; that practically an engineer should be able to calculate, without a shadow of a chance of change, on its constant porosity, and the consequent quantity of the filtered water it will give. I hold this to be one of the most important requisites which should guide in the selection of a system of filtration, even more so than the cost.

In taking the liberty of addressing the Commission for the Health of Towns, I wished to call their attention to the existence of such a system, not with the intent of entrapping their approbation for the purpose

of puffing a mercantile speculation, but that they might assure themselves, by any means they thought proper, by continued examination and experiment under the sole control of any person they might direct to test it, that there was such a system capable of application in all localities capable of filtering the whole of the New River water on less than half an acre of land, on the premises that Company now hold at the New River Head, applicable to small communities as well as the largest, possessing all the qualities required for a permanent constant filtration, viz. uniform and unvarying porosity, durability, a constantly pure and unfermentable filtering medium, certainty of product, and moderate cost; and that consequently the existing Water Companies could not allege the non-existence of an unobjectionable system, applicable to their present works, as the reason for not filtering their water.

With permission of the Board, I will give a description of Mr. Maurras's filter, its costs and results, with some documents having relation to it, or presenting some interest in connexion with the subject of water.

* * * *

The material he employs, viz. sand, is unobjectionable. The porosity of the filtering bed does not vary, and may be calculated on for any time. The whole machinery is almost indestructible; and the total cost of the system, as applied to the supply of filtered water to a large population, is so moderate, that the water supplied to a poor man's tenement may be filtered at from 2*d.* to 3*d.* per annum, according to circumstances, as I will presently explain. I will first briefly describe a single filtering machine. Any quantity of water may be filtered by a number of such machines connected together and filtering simultaneously, and the product constantly calculated on to a few gallons. The engraving, fig. 1, represents a section of a double-action filtering machine, acting *per ascensum et descensum*. It represents a water-tight iron box or case *x x*, the entrance into which for the dirty water is by the pipe A; the exit for the filtered water by the pipe C. The water in its passage through the box follows the direction of the arrows, and divides into two currents, one traversing the filtering beds D of the coarser sand, E of the finer sand; the other current traversing the beds F of the coarser sand, G of the finer sand, meeting in the central chamber, and passing off filtered by the cock H^3 and pipe C.

B^1, B^2, B^3 are water chambers communicating with the pipes A and B by sluice cocks at $H^1 \ldots H^{10}$; by means of these cocks the direction of the current of water may be varied at pleasure. One of the principal novelties and ingenious contrivances of the invention, and on which its continued efficacy mainly rests, consists in the simple and successful manner in which the sand of the filtering beds is retained and prevented from escaping with the water under the pressure of the filtering water, and the severe shocks it is found necessary to produce in order to detach and discharge the dirt from the filtering beds. This retention of the filtering sand is effected by the retaining boxes R R, which are closed boxes, whose upper and under surfaces are pierced with small holes of a certain diameter, which I will represent by 5, and filled and tightly packed with riddled sand of a diameter say 6, consequently incapable of passing through the small holes of the pierced plates of the retaining box: thus the sand in these boxes is a large-grained sand easily retained, but the interstices between its grains are sufficiently small to retain the fine-grained sand of the filtering beds, the theoretical proportion being $\frac{1}{6\frac{1}{2}}$. This principle, thus applied, meets the difficulty hitherto not overcome of retaining fine sand: it does it perfectly. The finest silver sand has been retained in an experiment of three months' filtration, under a pressure of a column of 60 feet of water. The principle admits the very perfect method of cleansing at intervals by the return of a current, and the shocks given by suddenly stopping it off, or meeting it by a reverse current having equal velocity. This is done by means of the sluice cocks $H^1 \ldots H^{10}$, four of which, being arranged to open and shut simultaneously, suddenly change the direction of the current, by which a violent agitation is produced between the pores of the filtering sand and the dirt dislodged and carried away. Fig. 2 is a view of part of the exterior, showing, *x x*, the doors for the introduction of the sand.

The great principles of the filter are sufficiently evident—that the filtering material is sand of various degrees of fineness, so arranged that it cannot escape from its position in the machine, and that the dirt is effectually removed at intervals, and the porosity of the filtering sand restored.

The engravings represents a machine 5 feet 6 inches × 5 feet 6 inches, and having a filtering surface of 60 superficial feet, capable of filtering 150,000 imperial gallons in 24 hours, with a head of water 12 feet 6 inches. This result is based on the continued working of the filter at the New River Head for three months. The whole time it was in operation at the New River Head was four months. For the first month, under a pressure of 26 feet head of water, when Mr. Mylne made his first report

to the Board. The result of the Directors' inspection is contained in the minutes of the Board, dated 6th July, 1843. For the remaining three months the head of water was reduced to 12 feet 6 inches. Mr. Mylne was requested to make a second report,

Fig. 1.

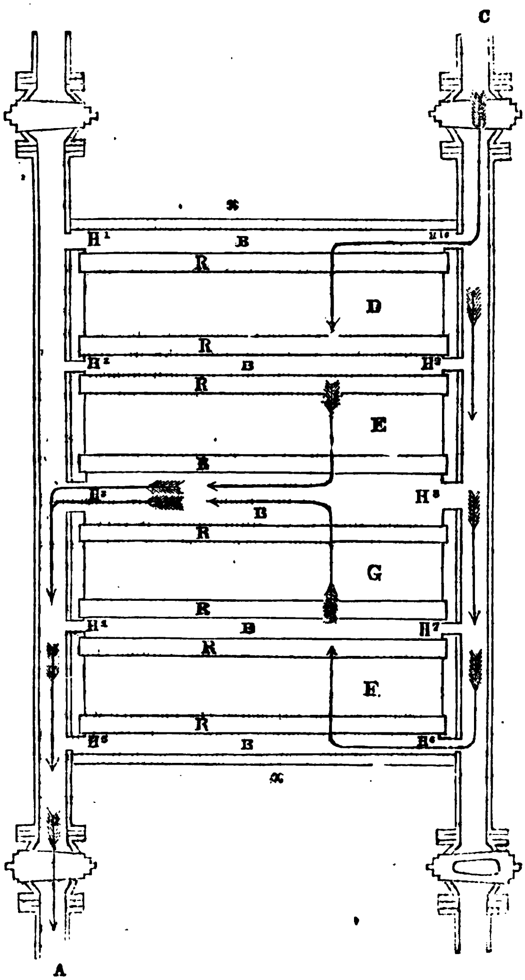
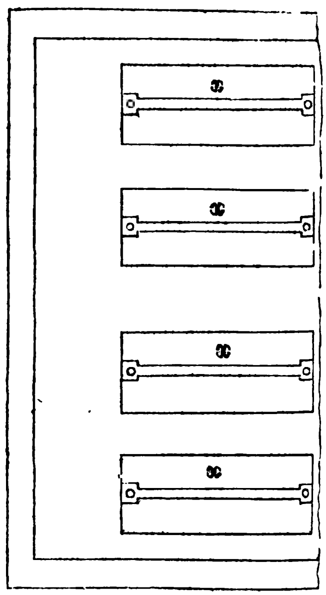


Fig. 2.



which, together with the minutes of the Board thereon, is dated 27th July, 1843. You will perceive that Mr. Mylne's estimate was made on the supposition that the water was to be pumped to an elevation of 33 feet, instead of 12 feet 6 inches, under which the filter was worked for three months, yielding a constant quantity of filtered water equal to 2,500 imperial gallons on every superficial foot of filtering surface every 24 hours. I subjoin copies of these reports in order to show the opinion of the New River Board and the Company's engineer on the practicability of the system, although for other reasons they did not then think it advisable to adopt filtration.

Extracts from Minutes of the New River Board.

"Minutes of Board, July 6th, 1844.

"The method of Mr. MAURRAS appears to the Board to be superior to any which has been brought under their notice, both in respect of its efficacy and the simplicity of the means employed.

"The committee see no reason to doubt that, with a sufficient number of machines, the whole quantity of water delivered by the New River Company (about 12,000,000 gallons daily) might be filtered in the time required for its delivery, *i. e.* within the twelve hours of day.

"Under these circumstances, the Board think Mr. Maurras's machines might be adopted with great advantage, not only as the best which have yet been devised for filtration, but as capable, in works not yet formed, of being substituted for other means of clarifying water which requires much larger expenditure."

Mr. Mylne's Report.

"The quantity of water discharged through the filter during ten minutes *before* cleansing was equal to 3 in. depth of the feed cistern, but after it was cleansed, the same quantity passed through in seven minutes, so that 8½ minutes may be taken as the average time to pass (in the present state of the river water) 3 in. in depth from the surface of the feed cistern, that depth being equal to 118¾* gallons of water.

(Signed) "W. C. MYLNE."

MEMOIR ON THE MANNER IN WHICH COTTON UNITES WITH COLOURING MATTER. BY WALTER CRUM, ESQ., VICE PRESIDENT OF THE PHILOSOPHICAL SOCIETY OF GLASGOW.

The effect of porous bodies in producing combination and decomposition, independently of chemical affinity, has, of late years, occupied considerable attention.

If we examine, says Professor Mitscherlich, a piece of box-wood by the microscope, we find it composed of cells which have a diameter of about $\frac{1}{2400}$th of an inch. Heated to redness, the form of these cells suffers no change, for the particles of which it is composed have no tendency to run together in fusion. A cubic inch of box-wood charcoal boiled for some time in water, absorbed five-eighths of its volume of that liquid; from which, and other data, it was computed that the surface of its pores was 73 square feet.

Saussure observed that a cubic inch of box-wood charcoal absorbed 35 cubic inches of carbonic acid; and as the solid part of the charcoal formed three-eighths of its bulk, these 35 inches of gas must have been condensed into five-eighths of an inch, or 56 cubic inches into one, under the ordinary pressure of the atmosphere. But carbonic acid liquefies under a pressure of 36·7 atmospheres, and, therefore, with a power of condensation equal to 56 atmospheres, which the charcoal exerted in Saussure's experiment, at least one-third of the gas must have assumed the liquid state within its pores.

Every other porous body has the same property as charcoal. Raw silk, linen, thread, the dried woods of hazel and mulberry, though they condense but a small quantity of carbonic acid, take up from 70 to 100 times their bulk of ammoniacal gas; and Saxon hydrophane, which is nearly pure silica, absorbs 64 times its bulk. The gases enter into no combination with the solid which absorbs them, for the air-pump alone destroys their union.

The manner in which gases are attracted to the surfaces of solid bodies is very much like that which these exert on substances dissolved in water. The charcoal of bones has been long employed to remove colouring matter from the brown solution of tartaric acid, from sirop in the refining of sugar, and from a variety of other liquids containing organic substances; and it is found that the coloring matter so attracted remains attached to the surface of the charcoal without effecting any change upon it. In this animal charcoal the carbon is mixed with ten times its weight of phosphate of lime, and if that be washed away by an acid, the remaining charcoal has nearly twice the decolorating power of an equal weight of ivory-black. Bussy, who has made the action of these charcoals the subject of particular investigation, informs us that if ivory-black, after the extraction of its earth of bones by an acid, be calcined along with potash, and the potash be afterwards washed out, or if blood be at once calcined with carbonate of potash and washed, the remaining charcoal has the power of decolorating twenty times as much sirop as could be done by the original bone charcoal. Animal charcoal removes, also, lime from lime-water, iodine from a solution of iodide of potassium, and metallic oxides from their solutions in ammonia and caustic potash.

A satisfactory explanation of these remark-

* N.B.—118¾ gallons of water filtered in 8½ minutes is equal to 2,509 gallons of water filtered upon every superficial foot of the filtering surface in 24 hours.

able facts has yet to be sought for. Mitscherlich calls the force which produces them an action of contact, or attraction, of surface; and he calculates, as we have seen, the extent of surface in proportion to the mass as the measure of the force which it exerts. On the other hand, Saussure, in his valuable paper on the absorption of gases, informs us that charcoal from box-wood, in the solid state, absorbs twice as much common air as when it is reduced to powder. Now the effect of pulverization is certainly not to diminish the extent of surface. Saussure accounts for it in another way, and his explanation seems to connect many of the facts. The condensation of gases in solid charcoal goes on, he conceives, in the narrow cells of which it is composed, and is analogous to the rise of liquids in capillary tubes. In both, he says, the power appears to be in the inverse ratio of the size of the interior diameters of the pores, or tubes of the absorbing bodies. When we pulverize a body containing such cells, we widen, open, and destroy them. Fir charcoal, whose cells are wide, absorbs 4½ times its bulk of common air, and box-wood charcoal with smaller pores takes 7½. Charcoal from cork, with a specific gravity of only 0·1, absorbs no appreciable quantity.

It appears to me that many of the operations of dyeing depend upon this influence of the surface, or the capillary action described by Saussure.

The microscopic examination of the fibres of cotton by Mr. Thompson, of Clitheroe, and Mr. Bauer, shows them to consist of transparent glassy tubes, which, when unripe, are cylindrical, and in the mature state collapsed in the middle, from end to end, giving the appearance of a separate tube on each side of the flattened fibre.

In many of the operations of dyeing and calico printing, the mineral basis of the colour is applied to the cotton in a state of solution in a volatile acid. This solution is allowed to dry upon the cloth, and in a short time the salt is decomposed, just as it would be in similar circumstances without the intervention of cotton. During the decomposition of this salt its acid escapes, and the metallic oxide adheres to the fibre so firmly as to resist the action of water applied to it with some violence. In this way does acetate of alumine act, and nearly in the same manner acetate of iron. The action here can only be mechanical on the part of the cotton, and the adherence, as I shall endeavour to show, confined to the interior of the tubes of which wool consists. The metallic oxide permeates these tubes in a state of solution, and it is only when its salt is there decomposed, and the oxide precipitated and reduced to an insoluble powder, that it is prevented from returning through the fine filter in which it is then inclosed.

When the piece of cotton, which, in this view, consists of bags lined inside with a metallic oxide, is subsequently dyed with madder, or log-wood, and becomes thereby red, or black, the action is purely one of chemical attraction between the mineral in the cloth, and the organic matter in the dye vessel, which together form the red, or black, compound that results; and there is no peculiarity of a chemical nature from the mineral constituent being previously connected with the cotton. The process of cleansing in boiling liquids, and in the wash-wheel, to which cotton printed with the various mordants is subjected, previous to being maddered, is to remove those portions of metallic oxide which have been left outside the fibres, or got entangled between them, and fastened there, more or less firmly, by the mucilage employed to thicken the solution.

The view I have now given, is, in some respects, the old mechanical theory of dyeing held by Macquer, Hellot, and Le Pileur d'Apligny before the time of Bergmann. Although unacquainted with the microscopic appearance of cotton, d'Apligny argued that as no vegetable substance in its growth can receive a juice without vessels proper for its circulation, so the fibres of cotton must be hollow within. And of wool, he says, the sides of the tubes must be sieves throughout their length, with an infinity of lateral pores. We may gather also that he conceived dyeing to consist, first, in removing a medullary substance contained in the pores of the wool, and afterwards depositing in them particles of a foreign colouring matter.

But Bergmann, in his Treatise on Indigo, in 1776, upset all this, and attributed to cotton a power of elective attraction, by which all the phenomena of dyeing were referred to purely chemical principles. Macquer soon adopted the chémical theory, and it was keenly advanced by Berthollet, who succeeded Dufay, Hellot, and Macquer, in the administration of the arts connected with chemistry. Berthollet has been followed by all, so far as I know, who have since that time written on the subject, but nothing like evidence has ever been produced; and if we only consider that chemical attraction necessarily involves combination, atom to atom, and, consequently, disorganization of all vegetable structure; that cotton wool may be dyed without injury to its fibre, and that that fibre remains entire, when, by chemical means, its colour has again been removed,

we shall find that the union of cotton with its colouring must be accounted for otherwise than by chemical affinity. In particular processes, as we shall afterwards see, attraction is no doubt exerted; but it is an attraction connected with structure, and, therefore, more mechanical than chemical.

When we examine with a powerful microscope a fibre of cotton, dyed either with indigo, with oxide of iron, chromate of lead, or the common madder-red, the colour appears to be spread so uniformly over the whole fibre that we cannot decide whether the walls of the tube are dyed throughout, or that the colouring matter only lines their internal surface. But the microscope shows that the collapse which occurs in raw and bleached cotton is very considerably diminished in the dyed.

The greater number of specimens of Turkey-red, which I have examined, show the same uniformity of colour; but in others of them, little oblong balls appear all along the inside of the tube, of the fine pink shade of that dye, while the tube itself is colourless. It is in stout cloth dyed in the piece that these rounded masses occur, and the observation has been confirmed by several of my friends who are practised in microscopic research. But I shall resume these observations with a more perfect instrument, which I hope soon to possess.

We have moreover the powerful analogy of the arrangement of the colouring matter in plants, in support of this view of the case. "Cellular tissue," says Dr. Lindley, in his Introduction to Botany, "generally consists of little bladders, or vesicles, of various figures adhering together in masses. It is transparent, and, in most cases, colourless; when it appears otherwise, its colour is caused by matter contained within it." . . . . "The bladders of cellular tissue are destitute of all perforations, so far as we can see, although, as they have the power of filtering liquids with rapidity, it is certain that they must abound in invisible pores." . . . . "The brilliant colours of vegetable matters, the white, blue, yellow, scarlet, and other hues of the corolla, and the green of the bark and leaves, is not owing to any difference in the colour of the cells, but to the colouring matter of different kinds which they contain. In the stem of the garden balsam, a single cell is frequently red in the midst of others which are colourless. Examine the red bladder, and you will find it filled with a colouring matter of which the rest are destitute. The bright satiny appearance of many richly coloured flowers depends upon the colourless quality of the tissue. Thus in *Thysanotus fascicularis*, the flowers of which are of a deep brilliant violet, with a remarkably satiny lustre, that appearance will be found to arise from each particular cell containing a single drop of colouring fluid, which gleams through the white shining membrane of the tissue, and produces the flickering lustre that is perceived." Cotton is itself cellular tissue, and the ligneous basis of all the forms of these vessels has the same chemical constitution.

I have alluded to another class of processes in dyeing in which the action much more resembles chemical affinity. I mean that in which pure cotton, by mere immersion in different liquids, withdraws a variety of substances from their solution. The "indigo vat," is a transparent solution, of a brownish yellow colour, consisting of deoxidized indigo combined with lime, and containing seldom more than $\frac{1}{500}$th of its weight of colouring matter. By merely dipping cotton in this liquid, the indigo attaches itself to it in the yellow state, in quantity proportioned within certain limits to the length of the immersion, and all that is then necessary to render it blue is to expose it to the air. Here an inactive spongy substance exercises a power which overcomes chemical affinity, but the mixture, which is formed of cotton and indigo, possesses none of the characters of a chemical compound. We can only recognize, in this action, the same force, whatever that may be, which enables animal charcoal to decolorate similar liquids. Charcoal, as we have also seen, withdraws metallic oxides from their solution in alkalies. Cotton wool has the same power, and it is extensively used as a means of dyeing with the yellow and red chromates of lead. If lime in excess be added to sugar of lead, dissolved in a considerable quantity of water, the lead which precipitates is redissolved in the lime water, and forms a weak solution of plumbate of lime. If a piece of cotton be immersed in this solution it appropriates the lead, and when afterwards washed, and dipped in a solution of chrome, the lead becomes chromate of lead.

The same force enables cotton to imbibe basic salts of iron and tin by immersion in certain solutions of these metals; and many other examples of what Berzelius calls a cytalytic force, in decomposing weak combinations, will occur to those who are familiar with the art of dyeing.

It appeared to me interesting to compare the amount of surface exposed by cotton wool, with that of the more minute divisions of charcoal. I am enabled to furnish the following calculation through the kindness of Professor Balfour, who has measured with great care the fibres of various qualities of wool. The fibre of New Orleans wool

varies most commonly from $\frac{1}{1500}$th to $\frac{2}{2000}$th of an inch in diameter. About forty of these fibres, or tubes, compose a thread of No. 38 yarn, (thirty-eight hanks to the pound.) Ordinary printing cloth, has, in the bleached state, 493 lineal feet of fibre, or 10·6 square inches of external surface of fibre in a square inch, which weighs nearly one grain. It is easy to compress 210 folds of this cloth into the thickness of one inch. It has then a specific gravity of 0·8. One cubic inch has 94·163 lineal feet of tube, and 16·8 feet of external surface; or, if we include the internal surface, there are upwards of 30 square feet of surface of fibre in one cubic inch of compressed calico. The charcoal of box-wood, has, as we have seen, 73 square feet of surface to the inch, with a specific gravity of 0·6.

EXPLOSIVE COMPOUNDS.

[From a letter of Professor Murray in the *Mining Journal*.]

"I prepare the iodide of nitrogen by leaving iodine in strong ammonia for, say, twenty-four hours; a less time will do, but I prefer the lengthened period. I then remove the iodide by means of a platinum spoon, and place it on slips of blotting paper in small portions. A few hours will suffice for its being dried, when it may explode spontaneously, or the contact of a slip of paper will cause its explosion, and even its being let fall through the atmosphere. The separation of its elements, in the act of explosion, is accompanied by a flash of light, and that explosive force is very violent. I find that when I touch it with a little of the solution of phosphorus in sulphuret of carbon, the latter is brilliantly ignited on the explosion taking place. In experiments with this substance, everything in the shape of glass must be removed. I see no method of the safe application of the iodide of nitrogen. The bichloride of nitrogen may be made in the following manner, and it is needless to say that the process must be diligently watched:—Into a solution of the nitrate of ammonia, contained in a tinned vessel, about ten inches diameter, and three inches deep—the solution being at a temperature of 110° Fah.—I introduce a bell glass, with a wide mouth and air-tight stopper, replenished with chlorine, prepared on the moment; this is done with a shallow tray of tinned iron. The liquid will presently be found to rise slowly into the inverted bell glass, from the gradual absorption of the chlorine. In the meantime, an oily looking film pervades the surface, which condenses towards the centre, and falls to the bottom in the form of a limpid globule, about the size of a turnip seed—if about a pint and a half of chlorine has been used. As soon as the globule falls to the bottom, the stopper is cautiously and gradually withdrawn, the liquid falls to the common level, and the bell glass must be entirely removed, which obviates a source of great danger. If, now, the tip of a rod dipped into olive oil, or a bit of caoutchouc, myrrh, &c., be brought into contact, it explodes with great violence, and the force with phosphorus is truly formidable. On one occasion, the steel blade which was used in the experiment was shivered to atoms, and in another instance the tin canister was torn to fragments, which were imbedded in the ceiling, and the table on which it rested shattered to pieces. These were among my most dangerous experiments with this terrific compound; sulphuret of carbon disarms it of explosion. It is not likely that *liquid* carbonic acid has been used by Captain Warner, for the change of temperature, amounting only to a very few degrees, might cause an explosion of fearful force.

"The power of fulminating mercury, under percussion, is very terrible; it is used now generally in 'percussion caps,' as a substitute for the 'percussion powder,' formerly employed, which I was among the first to recommend: it ignites at a temperature not much above 200° Fahrenheit, which forms a chief source of danger in its use. When simply ignited, it merely flashes like gunpowder, but does *not* detonate; when a portion of it is put on plate glass and ignited, it imparts to the surface of the glass a brilliant film of reduced mercury, forming a pretty mirror, and I find also that if a little be placed on a slip of paper, and held over the flame of a spirit lamp, it inflames; the paper is *not* charred, neither is it *perforated*, which happens always in the case of other explosive compounds."

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN AUGUST.

TREATISE on the THEORY and PRACTICE of NAVAL ARCHITECTURE; being the article "Shipbuilding" in the Encyclopædia Britannica. By Augustine F. B. Creuze, Member of the late School of Naval Architecture, President of the Portsmouth Philosophical Society, and Editor of the Papers on Naval Architecture. With 15 engravings on steel, and numerous woodcuts. 12s.

An ESSAY upon the UNION of AGRICULTURE with MANUFACTURES, and upon the Organization of Industry. By Charles Bray. 1s.

ELEVENTH ANNUAL REPORT of the ROYAL POLYTECHNIC SOCIETY. 1843. 2s.

CHAPTERS on WORKING PEOPLE; how to elevate their morals, and to improve their social condition. By Benjamin Love, author of the Handbook of Manchester.

ILLUSTRATIONS of the CLIMATE of GLASGOW, in a Series of Coloured Diagrams, exhibiting the

phenomena, and relations of the chief atmospherical changes from June 21, 1843, to June 31, 1844, deduced from the Registers of the Observatory, with explanatory notices. By J. P. Nichol, LL.D., Professor of Astronomy in the University of Glasgow. 16s.

HISTORICAL ESSAY on the RISE and EARLY PROGRESS of the DOCTRINE of LIFE CONTINGENCIES in ENGLAND. By Ed. Jones Farren. 4s.

JOURNAL of the ROYAL AGRICULTURAL SOCIETY of ENGLAND. Vol. 5, Part 1. 5s.

The APPRENTICE, a Weekly Journal of Art, Science, and Literature. Vol. I. 3s. 6d.

PARNELL'S APPLIED CHEMISTRY, in Manufactures, Arts, and Domestic Economy. Vol. 2. Contents.—Manufacture of Glass—Starch—Tanning—Caoutchouc; its Properties and Applications—Borax, and the Boracic Lagoons—Soap—Sulphur and Sulphuric Acid—Soda Manufacture. 13s.

Periodicals.

The London, Edinburgh, and Dublin Philosophical Magazine. No. 160. 2s. 6d.

The Edinburgh New Philosophical Journal. No. 74. 7s. 6d.

The Civil Engineer and Architect's Journal. No. 84. 1s. 6d.

The London Journal (Newton's). No. 152. 2s. 6d.

The Repertory of Patent Inventions. Enlarged Series. No. 22. 3s.

The Glasgow Practical Mechanics' and Engineers' Magazine. Part 35. 8d.

The Artizan. No. XIX. 1s.

The Builder. No. 76. 8d.

The Nautical Magazine. No. 19. Enlarged Series. 1s.

Pharmaceutical Journal and Transactions (Bell). 1s.

Annals and Magazine of Natural History, including Zoology, Botany, and Geology. By Sir William Jardine, Bart., P. J. Selby, Esq., Dr. Johnson, &c. No. 138. 2s. 6d.

The Zoologist. No. 20.

The Polytechnic Review. No. 2. By Dr. Sigmond and Dr. Stone.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65. FROM JULY 26TH TO AUGUST 27, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
July 26	227	William Peace	Haigh, near Wigan	The Elliptograph.
27	228	Lawson and Holden	Great Charles-street, Birmingham	Design for socket for carriage lamp.
30	229	William Cotton	3, Crosby-square, London	Cotton's balance for sovereigns
31	230	Capt. Lawrence Crawley	45, Edmund-street, Birmingham	Gun nipple cover, or nipple protector for regimental or company drill.
,,	231	John Rowan and Sons	Doagh Foundry, County Antrim.	Churning machine.
Aug. 1	283	William Henry Hine Akerman	Bridgewater, Somersetshire	Akerman's elastic general fitting clog.
2	233	The Brades Steel Company	Near Birmingham	Design for verge shears.
,,	234	Ditto	Ditto	Design for garden shears.
,,	235	James Wilson	37, Walbrook	Design for a ventilating hat.
3	236	J. Wells	Worcester	Glove of a new cut.
5	237	Thomas Wolferstan	Salisbury	Improved carriage spring.
,,	238	Charles Chinnock	Great Portland-street	Improved reclining chair.
,,	239	Edmund Spiller	98, Holborn-hill	The bachelor's tea-kettle heater.
6	240	William Wright	8, Great Queen-street, Lincoln's Inn-fields	Design for a metallic safety lucifer-match box.
7	241	Joseph Skertchley and Thomas G. Norman	Leicester	Clasp for ladies' dresses.
9	242	~~Frederick~~ William Lee	46, Southampton Buildings, Holborn	Lee's marine life-preserver.
12	243	Harry Gills	Birmingham	Harry Gill's new designed spur spring and box.
13	244	James Lane	Wimbourne-street, Hoxton	Design for a table bracket.
14	245	A. Kenrick and Sons	West Bromwich, near Birmingham	Design for apparatus for closing doors.
,,	246	Jane Leighton	Exmouth-street, Spa-fields	Book file.
16	247	Alfred Joy	Castle-street, Holborn	Deflecting glass for spiral lamp
19	248	James Comins	King-street, South Molton	Improved one way, turn over, or turn rest plough, also a hoeing, earthing-up or potato plough.
22	249	Richard Baker	Weymouth	Improved armillary sphere.
,,	250	Thomas Crump	Derby	Improved water-closet.
26	251	William Reynolds	Friendly-place, Mile-end	Improved quadrant.
,,	252	Samuel Dowrier	11, Greenhill-rents, Smithfield	Cylindrical elbow joint for stove piping.
27	253	William Pedley Alexander Shorn	2, Claremont-place, Pentonville. 40, Castle-street, Leicester-square	Segmental bottle.
,,	254	Edwin Rose	Ogley, Staffordshire	Roller.
,,	255	Kennedy and Asprey	49, New Bond-street	Portable ink and light box.
,,	256	James Vipond	Saint Mary-le-Strand-place	Two-wheel carriage.

LIST OF ENGLISH PATENTS GRANTED BETWEEN JULY 29, AND AUGUST 22, 1844.

Joseph Martin Kronheim, of Castle-street, Holborn, engraver, for improvements in stereotyping. (Being a communication.) July 29; six months.

William Ford, of Lawn End, South Lambeth, drain tile maker, for improvements in the manufacture of tubes for draining land, and for other purposes, and in drain tiles. July 29; six months.

Edward John Dent, of the Strand, chronometer-maker, for improvements in ships' compasses. July 30; six months.

Arthur Powell, and Nathanael Powell, of Whitefriars' glass works, glass manufacturers, for improvements in the manufacture of quarries, and other panes of glass for windows. July 30; six months.

Thomas Warne, of Blackfriars-road, pewterer and beer-engine manufacturer, for certain improvements in engines, machinery, or apparatus, for raising, drawing, or forcing beer, ale, or other liquids or fluids. July 30; six months.

Joseph Bentley, of Liverpool, gun-maker, for certain improvements in fire-arms. July 30; six months.

Elizabeth Cottam, of Winsley-street, Oxford-street, for improvements in heating what are called Italian irons. July 30; six months.

Pierre Armand Lecomte de Fontainmoreau, of Skinner's-place, Sise-lane, London, for certain improvements in coating or covering metals and alloys of metals. (Being a communication.) July 31; six months.

Benjamin Tucker Stratton, of Bristol, agricultural mechanist, for improvements in welding sheet iron for ship-building, and other uses. August 1; six months.

John Reed Hill, of Chancery-lane, London, engineer, for improvements in a press or presses, machine or machines, for letter-press printing. August 2; six months.

William Edwards Staite, of High-street, Marylebone, gentleman, for certain improvements in the processes and apparatus for preparing extracts and essences of vegetable and animal substances. August 3; six months.

Thomas Middleton, of Loman-street, Southwark, engineer, for certain improvements in machinery for the manufacture of artificial fuel. August 5; six months.

Julien Jeffreys, of Clapham, Surrey, gentleman, for improvements in respirators. August 6; six months.

Thomas Greenshields, of Oxford, architect, for improvements in the manufacture of salt. August 6, six months.

William Cormack, of Dalgleish-street, Commercial-road, East, chemist, for a new method or plan for purifying coal gas. August 15; six months.

John Whitehead, jun., of Elton, Lancaster, dyer and finisher, for certain improvements in the process of finishing fustians or beaverteens, satin-tops, and other similar cotton fabrics. August 15; six months.

Thomas Heaton, of Chorley, Lancaster, colliery agent, for certain improvements in hydraulic machinery, which is also applicable to raising other liquids. August 15; six months.

Alexander Ewing, of Dumbarton, Scotland, glass splitter, for certain improvements in the manufacture of crown glass. August 15; six months.

George Turner, of Gateshead, Durham, Doctor in Philosophy, for an improved mode of directing the passage of, and otherwise dealing with the noxious vapours and other matters arising from chemical works in certain cases. August 22; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22ND JULY TO THE 22ND OF AUGUST, 1844.

David Cheetham, of Rochdale, Lancaster, cotton spinner, and John Tatham, of the same place, machine maker, for certain improvements in machinery or apparatus to be employed in the preparation and spinning of cotton, wool, and other fibrous substances. July 23.

John Holland Butterworth, of Rochdale, Lancaster, cotton spinner, for certain improvements in machinery or apparatus applicable to preparation machines used in the spinning of cotton and other fibrous materials. July 23.

Jacques Bidault, of Paris, France, merchant, for improvements in applying heat for generating steam, and for other purposes, which improvements may be employed to obtain power. (Being a communication from abroad.) July 24.

James Caldwell, of Mill-place, Commercial-road, Middlesex, engineer, for improvements in cranes, windlasses and capstans. July 24.

James Hardy, of Birmingham, Warwick, gent., for certain improvements in the process of welding tubes, pipes, barrels, or hollow rods of malleable iron by machinery. July 30.

Joseph Hall, of Bloomfield Iron Works, in the parish of Tipton, Stafford, iron master, for improvement in the manufacture of horse-shoe nails. August 1.

Lawrence Hill, Junior, of Glasgow, civil engineer, for improvements in machinery for manufacturing shoes for horses and other animals. (Being a communication from abroad). August 1.

Charles Low, of Robinson's-row, Kingsland, Middlesex, for certain improvements in the making, or manufacturing of iron or steel. August 2.

William Sutcliffe, of Bradford, York, manufacturer, for improvements in preparing, dyeing, sizing, or dressing yarns, and manufactured fabrics of wool, flax, cotton, silk, and other fibrous materials. August 6.

William Isaac Cookson, Newcastle-upon-Tyne, engineer, for improvements in apparatus for burning sulphur in the manufacture of sulphuric acid. August 8.

James Smith, of Queen-square, Westminster esq., for improvements in slubbing, spinning, twisting and doubling cotton, and other fibrous substances. August 8.

William Losh, of Newcastle-upon-Tyne, esq., for improvements in the manufacture of metal chains for mining and other purposes. August 8.

Henry Bewley, of No. 3, Lower Sackville-street, Dublin, apothecary and chemist, and George Owen, of the same place, chemist, for improvements in the mode of confining corks or substitutes for corks in bottles and other vessels, whether made of glass, earthen or stoneware, containing liquids, charged or not charged with gas. August 9.

Anthony Lorimer, of Clerkenwell-close, Middlesex, bookbinder, for certain improvements in the apparatus and means of facilitating drawing from nature or models. August 9.

Pierre Armand Le Comte de Fontainemoreau, of Skinner's-place, Sise-lane, London, for an improved crane, called "Dynamometric." (Being a communication from abroad) August 10.

Pierre Armand Le Comte de Fontainemoreau, of Skinner's-place, Sise-lane, London, for a new mode of locomotion applicable to railroad and other ways. (Being a communication from abroad.) August 10.

Alexander Ewing, of Dunbarton, Scotland, glass-splitter, for certain improvements in the manufacture of crown glass. August 14.

Arthur Wall, of Bisterne-place, Poplar, Middlesex, surgeon, for certain improvements in the manufacture of steel, copper and other metals. August 16.

Stephen Hutchison, of the London Gas Works, Vauxhall, Surrey, engineer, for certain improvements in gas meters. August 16.

NOTES AND NOTICES.

Mechanical Force of the Cataract of Niagara.—When it is considered that the water-power of the cataract of Niagara is unceasing, by night as by day, and that the power for practical purposes in Great Britain, is only applied, on an average, about eleven hours per day, during six days of the week, it may be assumed that the motive-power of Niagara Falls is at least forty-fold of the aggregate of all the water and steam power employed in Great Britain, and probably equal to the aggregate of all the motive power employed for mechanical purposes on this earth. The surface of Lake Erie is found to be 331 feet above the surface of Lake Ontario, and 565 feet above that of the ocean. The descent of the waters of Niagara River, in the few miles of distance between Black Rock and Queenston, is about 171 feet, exclusive of the grand cataract itself, forming a succession of rapids, which, in some places, present to view the sublime spectacle of the agitated surface of the ocean in a storm; and these rapids continue to occur during the subsequent descent of the river St. Lawrence, from the level of Lake Ontario to that of the sea, making, in the aggregate, above three-fold of the waterfall of the grand cataract, and, consequently, one hundred and twenty fold of all the physical power derived from the use of all the waterfalls and steam-engines employed, as above stated, in Great Britain, omitting to take into account the several huge rivers that are tributaries of the St. Lawrence. Such, and on so great a scale, are the ordinary operations of the impulses of physical power employed in the "mechanics of nature," in governing the movements of the waters of a single river, exceeding manyfold the portion of physical forces rendered available and employed by all the inhabitants of the earth as a motive-power in the "mechanics of the arts."—*American Journal of Science and Art.*

Mechanical Force of Vegetation.—In Mr. Waterton's Essays there is a remarkable statement of a nut deposited for winter store by some nut-eating animal under an old mill-stone which lay in a field, springing up through the central aperture. "In order," says Mr. Waterton, "that the plant might have a fair chance of success, I directed that it should be defended from accident and harm by means of a wooden paling. Year after year it increased in size and beauty; and when its expansion had entirely filled the hole in the middle of the millstone, it gradually began to raise up the millstone itself from the seat of its long repose. This huge mass of stone is now eight inches above the ground, and is entirely supported by the stem of the nut tree, which has risen to the height of 25 feet, and bears excellent fruit."

Largest Ship on record.—The largest vessel on record was a ship constructed for Ptolemy Philopater, which had forty banks of oars. This vessel was rather a royal yacht, built to gratify the vanity of a court, than a ship intended for any useful purpose. It was 424 feet in length, and 58 broad. The height of the forecastle from the water was 60 feet. The longest oars were 58 feet, and the handles were loaded with lead to facilitate their motion. The equipage consisted of 4,400 men, of whom 4,000 were rowers. A ship constructed for the voyages of the court on the Nile was 330 feet long, and 45 feet wide.

The late Dr. Dalton was the first and only Quaker upon whom the honour of Doctor of Laws was conferred by the University of Oxford. He was installed at the visit of the British Association for the Advancement of Science in 1833.

Making Cloth by the Mile.—A paragraph has been going the round of the papers, stating that a manufacturer in Yorkshire is now executing an order for some eight miles of cloth, by which the public are evidently to understand what an immense order as to quantity of yards this Yorkshireman is executing. What will the same public say to the fact, that there are fifty firms connected with the cotton trade, in and near Manchester, who forward more than thirty miles of cloth per day.—*Leeds Mercury.*

Screw Wherry.—The experiments successfully made by Mr. James Aust (late of Malpass,) with his wherry, upon the river Usk, have conclusively proved the superiority of the screw principle, set in operation by manual labour, to that of rowing or sculling with oars. Mr. Aust entertains no doubt, that he shall construct a boat capable of being propelled, by manual labour alone, on any river, at from 12 to 15 or even 20 miles an hour!—*Monmouthshire Merlin.*

A Terra-Cotta Church.—Near Bolton-le-Moors a beautiful church has recently been built, entirely of terra-cotta—burnt clay—inside, outside, tower, and basement, all of the same material. A correspondent says—"The church is situated about a mile from Bolton, near the Haugh (called the Huff). It is built of a kind of fine clay, found near the spot, between the beds of coal, in Mrs. Fletcher's mines; it is subjected to a great pressure, and then burnt. The colour is rather good—a kind of tawny.—*Liverpool Mercury.*

Etching.—The inventor is not known. Perhaps the earliest specimen is the well-known "Cannon" by Albert Durer, dated 1518; and there is one by him, "Moses receiving the Tables of the Law," dated 1524. The art was soon after practised by Parmegiano, and extended to general use. Yet it is clear that the real power and merit of etching was not known to the inventor, nor to those who, in its early state, applied themselves to it. The first aim seems to have been exact imitation of the graver. Le Bosse, in his treatise on engraving, makes the perfection of the art consist in close similitude of the graver's work. It was this which at first cramped the artist, and delayed the progress of etching, and gave it not only the appearance but the reality of inferiority—and often times the name and reputation of inferiority is as prejudicial as the thing itself, and we verily believe that it still has its effect upon the public taste. Artists have not sufficiently taking to etching.—*Blackwood for August.*

Watch which never requires winding.—Captain Abbott mentions in his Narrative of a Journey to Khiva, a watch which belonged to the Russian General Perroffski, which never required winding—the motion of the wearer's body sufficing to wind it up.

Blasting by Galvanism.—The galvanic apparatus made by our ingenious townsmen, Messrs. Kemp, has been again successfully applied to the simultaneous ignition of a number of shots for the purpose of disintegrating a large mass of stone in the quarry of Rosyth Castle, about two miles above the Queensferry. The shots were arranged in a line along a ledge of rock 70 feet long, 9 feet broad, and between 7 and 8 feet thick. Being loaded with moderate charges of gunpowder, and connected by the conducting wires with a large and powerful galvanic battery, and all the other preliminary preparations effected, immediately on completing the galvanic circle, eleven shots, which had been charged with about 35 lbs. of gunpowder were instantaneously fired, and so great was the concentrated power of the simultaneous explosions, that the whole mass in front of the bores was instantly separated from the contiguous rock; the separated portion containing a mass of no less than 3780 cubic feet of stone, and weighing upwards of 260 tons.—*Edinburgh Witness.*

Coal in China.—The western mountains in the neighbourhood of Pekin are remarkable for the coal which they enclose. So abundant is it, that a space of half a league cannot be traversed without meeting with rich strata. Yet, either because of this very abundance, or from the inveterate habit which the Chinese have of leaving all things unper-

fected, the art of mining is yet in its infancy amongst them. Machinery to lighten labour is there unknown. They have not even an idea of the pumps indispensable to draw off the water. If local circumstances allow, they cut drainage galleries; if not, they abandon the working when the inundation has gained too far upon them. Their system of ventilation consists in making openings at certain distances, over which they place wheels turned by men; but these wheels, though incessantly in motion, introduce very little air into the mines. The mattock, pickaxe, and hammer, are the mining instruments; a furrow is traced with the pickaxe, the mattock is inserted and driven in with the hammer; and, in this manner, lumps of coal are detached, weighing from 60 lbs. to 80 lbs. Coal is at a moderate price in the capital.—*Capt. Pidding's Chinese Olio.*

Bituminous Lake.—Perhaps few of our citizens are aware that there is a small lake situate within 100 miles of Houston, that is quite similar to the Pitch Lake of Trinidad. This singular lake or pond is situate in Jefferson county, near the pond between Liberty and Beaumount, and about twenty miles from the latter village. The lake is formed of bitumen or asphaltum, and is about a quarter of a mile in circumference. In the winter months its surface is hard, and capable of sustaining a person. It is generally covered from November to March with water, which is sour to the taste; owing to this cause, it is called by the people in the vicinity the sour pond, or sour lake. In the summer there is a spring near the middle, where an oily liquid (probably petroleum) continually boils up from the bottom; this liquid gradually hardens after being exposed to the air, and forms a black pitchy substance, similar to that at the sides of the lake. Mr. Butler (of Galveston), who has seen the Pitch Lake at Trinidad, examined a piece of the bitumen obtained from this lake, and says it is precisely like the bitumen of Trinidad. This bitumen may, at some future day, become valuable as a substitute for coal in the formation of gas, to light cities. It burns, when lighted, with a clear bright light, but gives out a very pungent odour. The ancients used bitumen as a cement in the construction of walls and buildings; they also used it in many cases as a substitute for tar or pitch. We believe, however, little use is now made of it for these purposes, even where it is most abundant.—*Houston* (Texas) *Teleg.*

Antidote for Prussic Acid.—We feel much pleasure in announcing that some recent experiments made by Messrs. T. and H. Smith, of Duke-street, Edinburgh, with a view to discover an antidote for prussic acid, have been brought to a successful termination. It was previously well known that the acid might be neutralized, but a perfect neutralizing power, innoxious to the stomach in itself, easily used, and readily to be procured, has hitherto, as far as we are aware, been a thing altogether unknown. The sulphate of iron, commonly called green vitriol, was lately stated by Sir G. Lefevre to be an antidote to this poison, in the pages of the *Lancet.* It is not so, as the Messrs. Smith showed in reply. However, the presentation of oxidized iron to the deadly acid is in reality the fundamental feature of their own discovery. Only it was necessary to find out how to present it to the acid in the shape in which the acid will combine with it, and to do that safely is a difficult matter, as all medical men well know. The iron, as the late experiments demonstrate, must be in a state partly of peroxide, and partly of protoxide, when combined with which, only, will the acid form the desired compound, a compound well known as prussian blue, which is perfectly harmless in the stomach. It was the observation that in that salt the iron was peculiarly and doubly oxidized, which, while showing the uselessness of common sulphate of iron, suggested the formation of another combination of the sulphuric acid with the oxidized metal, which might take up the prussic acid, and form prussian blue. The accomplishment of this combination constitutes the antidote. The prussic acid is turned in the stomach to prussian blue; there an inert, harmless body.—*Scotsman.*

American Scraps.—The British steamer, *London*, Captain Baker, arrived at Oswego from Michigan, June 2. The navigation by steam is therefore open for the smaller class of vessels from Lake Michigan to the Ocean. In less than two years the whole Canadian route from Lake Michigan to the Ocean will be open to the large class of steamers; and it will be no uncommon sight to see ships up at the northern ports of Ohio direct for ports on the Atlantic, *via* the river St. Lawrence.——Orders sent to Buffalo, N.Y., into Staffordshire in England, for glass ware, are received back (Qy. the goods or the orders?) within 90 days.——The Montour Iron Company are about erecting at Danville, a new rolling mill, which will be the largest and most extensive establishment of the kind in the United States, and will probably cost 100,000 dollars. It is calculated that it will turn out annually about 10,000 tons of manufactured iron, a large portion of which is to be railroad iron; it will contain twenty-two puddling furnaces, consume all the iron manufactured at three furnaces of the same company, and give employment, directly and indirectly, to about 500 hands.——Some successful experiments have been lately made at West Point with a new kind of explosive shell, the invention of Scott and Burdick, of Albany. The advantages possessed by the new shell are that it is entirely closed, and thus not liable to sparks, or to the extinguishment of the fuse-fires when *ricochetting.* The time of the explosion can also be lengthened or diminished at pleasure, and the explosion is certain.——The pin factory of Messrs. Slocum, Jilson and Co., at Poughkeepsie, manufactures 1,300 lbs. of pins per day, of various sizes, and they are getting additional machinery ready by which they can soon manufacture 2,500 lbs. daily. They employ in the various branches of their operation 100 hands regularly; they use 380 tons of wire and between 2,000 and 3,000 reams of paper per annum; their pins sell upon the average at 25 cents per lb., making the annual value of their sales when their additional works are in full operation at least 250,000 dollars. In view of these facts, the question may be started, "What becomes of all the pins?"——The best boats now make the trip from New Orleans to Cincinnati in from 5 to 6 days, including stoppages. From New Orleans to St. Louis, in from 4 to 5 days. Thirty years ago a trip to New Orleans and back occupied at least six months.——The estimated expense of constructing a canal 12 feet deep and 100 wide, in the most substantial manner, connecting lakes Huron and Superior, is 454,107 dols. Its length will be about a mile.——Professor Morse has received for his magnificent work, the electromagnetic telegraph, 30,000 dols., authorised by act of Congress, in 1843.

Erratum.—In the List of Scotch Patents, page 63, for Robert *Dawson*, read Robert *Davison.*

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ALLIOTT'S PATENT SCOURING, BLEACHING, AND DYEING MACHINE.

Fig. 1.

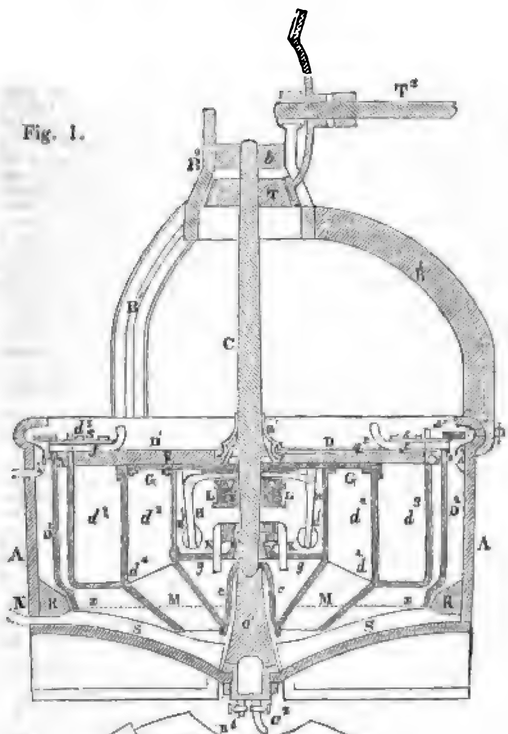
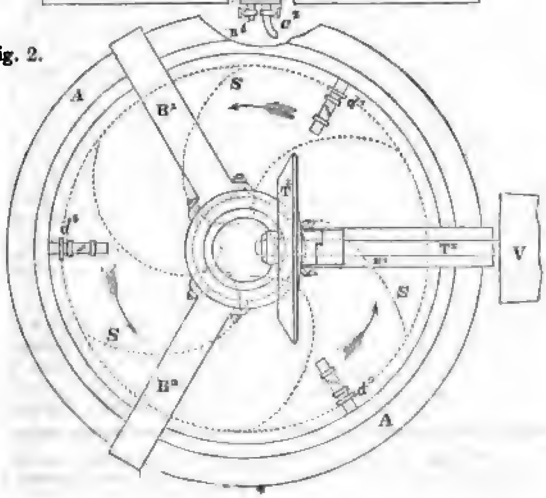


Fig. 2.



ALLIOTT'S PATENT SCOURING, BLEACHING, AND DYEING MACHINE.

[Patent dated February 24, 1844; Specification enrolled July 24, 1844.]

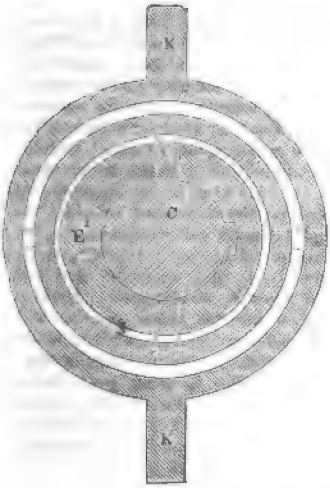
The present invention consists in an ingenious adaptation to scouring, bleaching, and dyeing, of the system of centrifugal action employed with such admirable effect in the drying machine of Messrs. Keeley and Alliott described in our xxxixth vol. p. 257. The liquids made use for any of these purposes are driven "centrifugally, rapidly and continuously (or in some cases intermittingly) through the goods operated upon." Two machines by which this may be effected are described by the patentee; we select the account of that which is likely to be more generally useful.

Fig. 1 is a top plan, and fig. 2 a sectional elevation of this machine.

"A is a circular pan, curved at the bottom in the manner shown; and a^1 a raised socket screwed firmly to the centre of this pan. B^1 B^2 B^3 is a three-armed frame work, which is bolted to, and rises upwards from the top of the pan, meeting at top in a common boss, B^4, to which they are also bolted. C is a vertical bolt, which turns at bottom in the socket a^1, and at top in a bearing b, let into the boss, B^4. D is a hollow drum, which is loosely fixed on the shaft C, and consists of three compartments, d^1, d^2, d^3. The innermost compartment, d^1 is completely boxed off from the others, and also from the socket a^1, and the lower end of the shaft C, by the partitions, c c; it is likewise divided near to the middle into two parts by a diaphragm g. The compartment d^2 is open at bottom, and in this open space are placed the curved plates, M M, afterwards described, by which the compartments d^1 and d^3 are connected together at the bottom. The compartment d^3, is closed at bottom. The external side d^2 down to the point d^4, where it inclines inward, and the whole of the external side of d^3, are perforated with numerous holes. The goods to be operated upon are placed in the compartment d^3, and the liquid is drawn upwards through the curved plates, M, in the bottom of the compartment d^2, and forced thence into and through the goods in d^3. D^2 is an outer case without any bottom, which surrounds the drum D^1, but is quite closed all round (with the exception of the orifices o o, afterwards described), and is inclined a little inwards from the top to the bottom; it is loosely attached to D^1 by the hinges, and further fastened to it when the machine is in action, by means of sliding bolts, $f f$. F is a lid adapted to the top of the drum d^1, which may be made fast or unfast, on putting in and taking out the goods, by locking or unlocking the bolts $f f$ before mentioned, which bolts are fixed into the top of this lid, and on being pushed forward pass through the heads of the upright bars d^5, bolted to the outside of the drum D^1, and through the angle rings at the top of the outer case D^2. On the top of these bolts there are springs, s s, which, when the bolts are pushed forwards, serve to raise the outer case D^2 into close contact at bottom with the drum D^1. G is a separate cover, which extends only over, and is bolted to, the two inner compartments d^1 and d^2. E^1 E^2 are two conical bearings attached to the shaft C, with corresponding conical boxes, e^1 e^2; one of which is fixed to the cover G on the inside, and the other to the top of the diaphragm G of the innermost compartment d^1. H H is a centrifugal governor, on the bent arms of which are loosely attached at the elbows, by a pin to a stud, which is itself attached by a joint to the cover G, while the horizontal parts at top pass through slots in the conical box e^1, and rest in recesses in the bearing E^1. k k are two arms which are connected at the shoulders by universal joints, (of which a sectional view on an enlarged scale is given in fig. 3,) to the shaft C, and pass downwards through holes in the diaphragm g, whereby, on the shaft C being caused to rotate, the arm D^1 is carried round along with it. As the velocity of the shaft and drum encreases, the weighted arms of the governor H H expand outwards, whereby the drum is lifted from its original bearings, and left at liberty to take from time to time the point of rotation determined by its centre of gravity. L L are springs placed between the flanges of the conical bearings E^1 and of the box e^1, to assist the action of the governor in raising the drum N. M M are curved plates which are fixed in the open space at the bottom of the compartment d^2, and serve to connect at the bottom the compartments d^1 and d^3; these plates are inclined in relation to the axis in such a way, that when the drum is revolving they serve as scoopers to draw up the liquid, which is afterwards projected by the centrifugal action forcibly against and through the outer perforated sides of the compartment d^2, into and through the goods in the compartment d^3. N is a valve by which the dyeing, bleaching, or other liquid is admitted into the pan A at bottom, to about the height of the line x^2, so that the bottom edge of the outer case D^2 may dip a little way therein. B is a ledge which projects from the inside of the pan, partly above and partly below the water line x^2, and is so shaped, as nearly to abut against the outer case D^2 at bottom; whereby

the air which might have a cooling and deoxidizing effect on the liquid, is to a great extent excluded. S are ribs (indicated by dotted lines in fig. 2,) on the bottom of the pan A, which are curved from the outside towards the centre, in such directions as to guide the liquid towards the scoops M M.

Fig. 3.



Z^1 is a hollow tube which encircles the vertical shaft C immediately above the top of the drum D^1, and is connected with a horizontal shaft Z^2, passed through one side or half of the lid F of the drum D^1 in the manner particularly shown in the separate views of these parts given in figs. 4 and 5.* This tube spreads outwards at bottom, and terminates in a curved piece x^1, which carries at top and bottom two level friction-wheels x^2 x^3, which act on a corresponding bevel friction-pulley Y on the inner end of the shaft Z^2. To the outer end of the shaft Z^2, is fixed a vertical endless screw Z^3. Into this vertical screw, works a toothed wheel, Z^4, the axis, Z^5, of which wheel has a right-handed screw turn on it at one end, and a lefted-handed screw at the other, and passes through two flanges x^4 x^5 of the ring Z^6, next to be described; these flanges being tapped to correspond. Z^6 is a ring valve cut across at one part, which is laid loosely in a groove in the lid F^1, and is connected to Z^5 by the two flanges x^4 and x^5, one at each end. This valve faces the orifices *o o* before mentioned, as being made in the outer case D^2, and closes them more or less, according as it is more or less expanded by the action upon it of the screw shafts and wheels with which it is in gearing. Z^7 is another ring cut through similar to Z^6, but smaller, which is laid in like manner loosely in a groove at a little distance above the other; this groove has a leathern cover fastened over it, which, when the machine is at work, is pressed outwards by the centrifugal action of the ring within, against the outer case D^2 of the drum, and prevents the escape past it of any of the liquid. According as the shaft Z^2 is turned to the right or left, the flanges x^4 x^5 are drawn further asunder, or brought nearer to each other; and the turning of that shaft in either direction, when the machine is at work, is effected by clasping the tube Z^1 by the hand, and either pressing down the top friction-wheel x^2, into gearing with the friction-wheel Y, or raising the lower friction-wheel x^3, so as to press upwards against the friction-wheel Y. T^1 is a bevel-wheel fixed on the top of the drum shaft C, below its top bearing *b*, and T^2 another bevel-wheel, which works into T^1 through an opening at one side of the boss B^4. T^3 is the shaft of the bevel-wheel T^2, and T^4 another shaft, and on these shafts are fixed two differential cones, V V, and two drums, W W, through the drum of which, motion is given to the bevel wheels and drum shaft from any first mover.

The mode of working with the machine is as follows:—

"The drum D^1, and its outer case D^2, being made fast together by the bolts at top, and also brought into close contact at bottom by the operation of the springs on the top of the bolts, and the compartment d^3 being filled with the goods, a rapid rotary motion is given to the machine by the means before described. The quantity of liquid required is now introduced gradually through the valve N, and as it rises to the level of the scoops M M, it is drawn up by them into the interior of the compartment d^2, and then driven, by the centrifugal tendency imparted to it by the rotation of the machine, against the perforated exterior sides of the compartment d^2, through which it passes into and through the goods in the compartment d^3, and thence into the outer case D^2. When the liquid accumulates in the outer case D^2 in quantity sufficient to overcome by its downward and outward pressure the power of the springs at top, the outer case is separated at bottom from the drum D^1, which allows the liquid so accumulated to flow back into the bottom of the pan A, to be again raised by the scoops M M, and returned through the machine as before; and by continuing the rotation of the machine, the same quantity of liquid may be driven through any number of such circuits of revolution found needful. When it is

* From a misconception of our instructions, the engravings of these figures are not ready, but will be given in our next Number.—Ed. M.M.

desired to change or draw off the liquid, the tube Z^1 is laid hold of, and its friction-wheel x^2 pressed against the pulley y, which, turning the shaft Z^2, causes the ring valve Z to contract, and the orifices o o in the outer case, D^2, to be thereby thrown open to the escape of the liquid through these orifices into a spout A^2 (the rotary motion of the machine being still kept up), which spout carries it off into any convenient reservoir for future use. As, however, the whole of the liquid cannot be ejected in this way from the machine, and a portion of it will still remain at the bottom of the pan, there is a tap B^1, by which this portion can be drawn off."

In some cases it may be found expedient to draw off, by the means before described, the liquid as soon as it has made only one or two circuits of revolution, and to replace it, after a brief interval, by another quantity of liquid, so that the goods may be partially dried in the interim. So, also, the same lot of goods may, without removing them from the drum, be operated upon by different sorts of liquids in succession; as, for example, they may have one liquid passed through them, and after being well washed with water, be treated with a second liquid.

When it is desired to use the liquids, or any of them, in a warm or hot state, steam is admitted into the pan A through a pipe C^2, connected with a steam boiler, whereby they may be raised to the required temperature.

THE NEW COMMERCIAL PRODUCTS FROM MADDER, GARANCINE AND COLORINE.*

Since 1836 two new products occur in commerce, which are destined to replace madder in the operations of dyeing and calico printing. One is known by the name of *garancine*, the other by the name of *colorine*.

The *garancine* is a more, or less, clear chocolate-coloured powder, without any decided smell or taste; it does not impart any colour to the saliva or to cold water, even by long contact.

This garancine is nothing further than the *charbon sulphurique* of MM. Robiquet and Colin, deprived of every trace of acid. A patent was taken out on the 26th of March, 1828, by MM. Lagier, merchant, and Robiquet and Colin, professors of chemistry, for the manufacture and sale of this new product. As the specification which contains the description of the process of manufacture has never been published in any scientific work, I think it right to notice it in this place.

"The problem to be solved," says the patentees, "is to obtain the whole of the colouring matter of the madder free from the foreign bodies which tarnish its lustre, and retain it in combinations different from those which it ought to contract with the mordants; now the madder in its natural state contains colouring matter in various conditions. Thus, in the dyer's bath it separates into two portions, one of which is either dissolved or suspended in the water, whilst the other remains fixed in the ligneous residue. In treating the exhausted residue, which is generally considered worthless, by the method described below, a quantity of colouring matter, at least equal to that first extracted from it, is obtained. Besides, the portion which the water carries with it, either in solution or in suspension, is far from being attracted by the mordant of the stuffs immersed in it. A great part remains in the bath, in combination with some substances which retain it with sufficient energy to prevent it from combining with the mordants beyond a certain limit."

The following is the process proposed by them:—"The madder is immersed in from 5 to 6 parts of cold water, and allowed to macerate all night in order that the portion of the colouring substance which dissolves at first may have time to subside; the whole is then thrown on to linen strainers, and when the liquid has passed through, the grounds are pressed; they are then immersed again in the same quantity of water, pressed, and this operation repeated once more. After these three washings, which serve to remove a green substance, besides sugar, mucilage, and other soluble substances, the grounds still moist and well crushed, are mixed with sulphuric acid equal to half the amount of madder first employed; it is however requisite that this acid should be diluted more or less with water, according to the temperature; this is done when it is about to be employed, in order to turn to account the heat set free by the mixture. The acid thus diluted is poured quite hot over the madder, it is then agitated as rapidly as possible, and when the mixture is thought to be well effected, the temperature is raised to 212° Fahr., and maintained for about an hour. At the end of this time the substance is again mixed with a suitable quantity of water, filtered, and washed on the strainers until the liquid passes off perfectly insipid. It is then pressed, dried, and passed through the sieve.

* From a Memoir on Madder by M. Girardin, Professor of Practical Chemistry in the Municipal School of Rouen, in the *Journal de Pharmacie*, and translated at length in the *London Chemical Gazette*.

"In this operation the acid has undergone no alteration; it has merely become weaker, and charged with some calcareous salts, which do not prevent its being employed in the manufacture of sulphate of soda. The first washing water might also be turned to account, since it contains much sugar, which might easily be converted into alcohol."

Garancine was first introduced into commerce by the house of Lagier and Thomas, of Avignon, towards the year 1829, who had brought the process and the patent of Robiquet and Colin; but this product did not meet with success in the market. The neutral state in which it was delivered not affording any correction to the calcareous waters ordinarily used in our Rouen print works, and the action of their alkali on the colouring principle not being properly understood, the experiments which were made with it on a large scale were far from corresponding to those made with smaller quantities, and threw it into great discredit. It was not until later (in 1832) that the same house in Avignon, assisted by the advice of chemists, again commenced some trials, the results of which proving satisfactory, led to the belief that its use might become of importance. At this epoch, however, the madder prints in vogue being very dark, and requiring a strong dye, could not be produced with garancine; the great quantity of colouring matter which they required, prevented its use on account of its price; but in 1835, the issue of certain kinds of coloured prints requiring very bright colours, again drew the attention of manufacturers to garancine, and it was generally adopted and approved of.

Many persons, foreseeing how important its consumption might become, started establishments for the manufacture of it on the expiration of Robiquet's patent granted to Lagier and Co. Want of experience in this process caused these first manufacturers to obtain but imperfect products, and many soon left off; but shortly after, some persons, profiting by the experience of their predecessors, again took it up, and there are now from twelve to fifteen manufacturers of garancine at Avignon, and one or two in Alsatia.

The manufacturers of Avignon employ only the madder of the Comtat; those of Alsatia are, it is said, obliged to add a small quantity of the former to the madder which they grow, in order to increase the quantity of colouring matter of their garancine.

From 1839, this substance began to be generally employed in several of the principal print works of Rouen, among others by M. Schlumberger-Rouff, who manufactured the garancine which he used according to the following process:—

After having ground the already pulverized madder on a table, by means of a thick wooden rolling pin, such as is used by pastry cooks, it is placed in a leaden basin, then moistened with a little water, and half its weight of sulphuric acid of 1·834 sp. gr. poured over it, whilst two men continually stirred the mass with shovels, walking around the basin. When the burning *(brûlage)* was ended, it was washed five or six times in barrels, the product drained upon linen, and then dried in a chamber heated by steam. It was afterwards ground in a water mill, made upon the plan of pepper, or coffee, mills. This garancine was very acid, and could not be used for violet colours. It cost 3 francs 75 centimes the kilogramme.

Originally, garancine was worth 6 francs the kilogramme. For the last three years, the current price, without distinction whence it came, has been from 4 francs 50 centimes to 5 francs the kilogramme, with a discount of 6 per cent.

Up to the present time it has not been possible to class garancines according to their quality. Each manufacturer seeks to obtain the best products with regard to the quantity of colouring matter, and also with regard to the brightness of the tints; but the impurity of the first matters, and the neglect of trifling circumstances which the manufacture requires, often cause the products of the same manufactory to vary considerably. In trade, garancines are met with which afford four times more colouring matter than the madder which was employed to obtain them, whilst others give but two and a half.

This want of regularity is as much dependent on the degree of richness of the madder employed, as on the operations necessary in the production of the garancine; there is so much danger of burning the madder too much, or too little, that it is quite impossible to produce an identical garancine during a year. In great manufactories it is hardly possible to make from fifteen to twenty barrels which shall be nearly alike; for which purpose it is even necessary that the whole mass of roots required should be treated at one time. In general, good garancines possess three times as much richness of dye as the good madders.

The same mode of classification has not been adopted for the garancines as for the madders; the former are only distinguished by the names of the manufacturers.

The garancine, both of Rouen and Alsatia, is packed in casks of from 200 to 300 kilogrammes. That of Avignon is exported in

casks, lined interiorly with blue paper, and with the jointures coated with tar.

During the last three years the consumption of garancine has been pretty regular; it may be calculated at from 1,600 to 1,800 barrels a year from Avignon, and from 400 to 600 barrels from Alsatia.

Before the introduction of this product into our manufactories, the yearly consumption at Rouen was from 3,200 to 3,500 barrels of Avignon madder, and about 1,000 of Alsatian. For the last three years not more than about 2,000 barrels of Avignon madder have been consumed, and 200 barrels from Alsatia. This diminution of nearly half the consumption of madder, is more than compensated by that of the garancine, and the Lizarus. The consumption of these last has, however, been almost nothing for five or six years; it may be valued at from 500 to 600 bales of every growth a year.

The following is the behaviour of garancine towards solvents:—

Cold distilled water	After 24 hours of contact it has only assumed a pale yellowish colour.
Distilled boiling water	Acquires a pale reddish yellow tint.
Cold calcareous water	After 24 hours it is less coloured than with cold distilled water.
Boiling calcareous water	A somewhat paler tint than with distilled boiling water.
Cold lime water	After 24 hours the tint is paler than that with distilled boiling water, and than that with boiling calcareous water.
Water acidulated with sulphuric acid	Takes, after some hours, a slightly greenish yellow tint.
Water acidulated with hydrochloric acid.	Id., a rather darker tint.
Cold distilled water acidul. with nitric acid,	Id., a rather darker tint, and the blackish gray powder becomes of a brownish red, resembling madder become brown by age.
Cold distilled water acidul. with acetic acid,	Becomes faintly yellow.
Acetic acid of 1·0704 specific gravity	Acquires, after several hours, a beautiful reddish yellow colour.
Caustic ammonia	Becomes red immediately, and after 24 hours the liquor is strongly coloured crimson red, so intense that it is no longer transparent in a great mass.
Water slightly alkalized by ammonia	Immediately assumes a beautiful claret red colour.
Caustic soda	A dark reddish brown colour.
Water charged with carbonate of soda	Acquires quickly a bright reddish colour of Burgundy wine.
Cold alum water	Becomes almost immediately of a chrome red colour.
Boiling alum water	Acquires immediately a dark red colour, and, upon cooling, deposits flakes of the same colour, but paler.
Alcohol of specific gravity 0·863	Assumes rather quickly a slight reddish yellow colour.
Hydrated ether	Id., id.

Dyeing with garancine is effected in just the same manner as with madder. It is more advantageous, however, to raise the bath at once to 113° Fahr., and then gradually to 167° or 176°. Garancine only yields its colour to the tissue impregnated with the mordant at a boiling temperature. The water of the bath acquires no colour even after ebullition, which always terminates the dyeing with garancine.

The mordants are the same as those which are employed for dyeing without madder.

For certain colours in which there is no violet, sumach is sometimes added to the bath to the amount of about a third of the garancine employed. At other times, for red grounds, for instance, the pieces are quercitroned before garancing, which imparts much brightness to the red, but renders the violet grey.

The proportion of garancine used in dyeing calico prints varies considerably, according to the intensity of the tints, and the quantity of colour required by the pattern.

When the garancines are neuter, and the waters are calcareous, which is general in Normandy, they must be corrected by adding a variable proportion of sulphuric, acetic,

or oxalic, acid to the bath. 1 centilitre of sulphuric acid of 1·028 to 9 litres of water, or 15 centigrammes of oxalic acid to a litre of water, are about the quantities employed. When sumach is added, no acid is employed.

There are some garancines which are badly washed and acid, and to which it is therefore necessary to add chalk, or alkaline carbonates, in order to get rid of the too great excess of acid, which would be injurious; but chalk and alkalies are avoided as much as possible.

The great advantage of garancine is that it does not *charge* the white, and that the bleaching of the stuffs dyed with garancine is reduced to a mere nothing. When a very pure white is not required, it suffices merely to beat, and sufficiently clear, the pieces after the garancing. When a perfect white is required, the pieces are passed through bran for fifteen or twenty minutes. Hot water, or bran, are the only means used for clearing them. In this respect, therefore, garancine possesses a great advantage over madder, which covers all the whites, and which renders it necessary to use soap, and to clear them more or less after the process of dyeing.

The tints obtained with garancine are generally more brilliant and lively than those with madder. The *red* is vivid, of a carmine colour of extraordinary purity, whilst the madder red placed by its side is always somewhat yellow, or of a fawn colour, and dull, but, on the other hand, fuller. The *puces* and garnets made with garancine are much more velvety than those dyed with madder. The *violets* are not so pale, and delicate, and grey as with the latter. All the tints are weaker, and cannot so well bear soaping; they also require great care in the clearing, and resist less the action of the atmosphere and of the sun.

All the garancines, however, do not afford tints of equal richness and brilliancy. Some kinds produce a beautiful red, but a bad violet colour; other kinds afford a magnificent puce, or violet, while the red is dull brown.

Garancine was first employed in the calico print works of Normandy. The Alsatian works refused to use this product for a long time; they only began to employ it about two years ago, in imitation of the calico printers of Rouen.

M. Leonard Schwartz, of Mulhausen, has recently sent into commerce, garancine prepared from the residue of madder, which has been already used for dyeing. This matter, which he very improperly calls *garanceux*, is of much less value than the good Avignon garancine; 3½, and even 4 parts, are scarcely equal to 1 part of the latter. It costs 2 francs 25 centimes the kilogramme.

The *Colorine* of commerce is the residue from the distillation of the alcoholic liquid obtained in the treatment of the *charbon sulphurique* with spirits of wine. The residue, which consists of *alizarine*, still impurified with a little fatty matter, is in the form of an extract when withdrawn from the retort. It is diluted with a little water, and pressed, in order to separate the fatty matter from it as much as possible. When dry it is reduced to powder. This is Robiquet and Colin's* *alcoholic extract of charbon sulphurique*, which MM. Ligier and Thomas, of Avignon, brought into the market in 1836, at 75 francs the kilogramme.

This product is in the form of a very fine powder, of a yellow ochre colour, without any decided smell, or taste; moistened, it stains the fingers strongly of a yellow colour, but it hardly colours saliva. It presents all the chemical characters which Robiquet and Colin assigned to their alizarine.

The expectations which had been entertained by these skilful chemists, as early as 1827, as to the possibility of using alizarine for obtaining colours of application, were realized in 1837, by M. Pariset, of Rouen, who was then chemist in the works of MM. Feer, Dolffus and Company, of Dieppdalle, and formerly pupil of M. Chevreul; and simultaneously in 1838, by M. Gastard, chemist to M. Stackler, and M. Daniel Fauquet-Delarve, of the print works at Deville. Colorine dissolved in ammonia, and the liquor being thickened with gum, affords, in fact, when printed on calicoes with aluminous mordants, and exposed to steam, red and rose colours, which are by no means inferior to those obtained with madder dyes. A patent for fifteen years was taken out on the 24th of November, 1837, by M. Stackler, for the carrying out the processes of M. Gastard; but the high price of the colorine of MM. Lagier and Thomas prevented their adoption in the print works. The same was the case with regard to the processes of M. Daniel Fauquet, who obtained in large quantities more intense and richer reds than those of M. Gastard. M. Fauquet's processes possessed another advantage, in so far as he was able to cause his red to *re-enter* (*rentrer*) upon black grounds dyed with logwood and other dyes, and as this red did not require so many clearings as that of M. Gastard, to obtain vividness and brilliancy. M. Fauquet manufactured a large number

* See MM. Rob'quet and Collin's Memoir, (Bulletin de la Société Industrielle de Mulhausen, vol. i. pp. 177 178, and 181.)

of prints with applied red and rose colours, both in England and Scotland, but the enormous price of the primitive matter prevented his continuing. The Society of Emulation, of Rouen, on my report, decreed medals of encouragement to MM. Gastard and Fauquet, in 1839, for being the first to convert an experiment of the laboratory into an operation of the arts, and showing, in an indisputable manner, the justice of MM. Robiquet and Colin's presuppositions, viz., that it is possible, and even advantageous, to manufacture on a grand scale solid colours direct from the madder.

In 1840, M. Grelley and I undertook to investigate carefully the possibility of the practical application of the pure alizarine of Robiquet, a problem of the greatest consequence, since the *Société Industrielle*, of Mulhausen, proposed, in 1834, a premium of 19,900 francs, to be raised by subscription amongst the principal dyers and calico printers of France, for the *discovery of a red of application from madder*, the price of a pot of the colour (containing two litres) not to exceed 10 francs.* This premium, which was continued until 1839, was never gained, and has been withdrawn. These facts show the great difficulty of the question. M. Grelley and I have at last been able to solve it, by obtaining colorine at a price which allows of its being generally employed in producing red and rose colours of a good tint. We have described our processes in two *sealed packets*, deposited in the *Archives de l'Académie des Sciences*, dated 24th June, 1841. We have since brought our processes of extraction to greater perfection. Our product is of as good a tint as the best reds obtained in the ordinary method of dyeing; it bears all the customary clearings, and since it is far more brilliant even in its natural state, it more readily yields to the action of the clearings than the ordinary madder-reds. Used in very small quantities, it resists the strongest clearings that are employed for Turkey red, which generally requires an excess of colouring matter. This product may be used with the greatest facility. It is mixed with weak ammonia, and left in it to swell; it is then thickened with gum water, or with gum in powder, and applied to the tissue. The operations it requires after its application, only consisting in a simple steaming and rinsing with pure water, it may be printed, in every case, with all the other ordinary steam colours, provided it is not intended to be cleared. The preparations preliminary to its application allow of its being applied to black grounds, or others obtained with matters of weak tint. It can be used of different degrees of strength on the same stuffs, and it is thus possible to obtain tints from a pale red to the very darkest red.

We have applied it on black and white grounds, which, up to the present time, were injured in the ordinary operations of dyeing. We have also applied it with catechu, when the clearing required was merely a simple soaping.

VIPOND'S IMPROVED TWO-WHEEL CARRIAGE.

[Registered under the Act for the Protection of Articles of Utility.]

Figure 1 is a side view of this carriage; fig. 2 a front view, and fig. 3 a plan.

A is the body, which is of a square form in front, but curved behind, and T T the shafts. B is the axle, which, instead of being straight, or bent downwards, as usual, is curved horizontally backwards in the manner shown in fig. 3. C C is the passenger's seat, which is curved in the same way as the axle. D is the driver's seat, which is placed on the top of the body at the centre, and made to slide forwards and backwards in a dovetailed groove *g*, in order that it may be shifted according as the weight carried inside may make it expedient to shift the weight of the driver, in order the better to balance the carriage. E is a lever, with a handle by which the seat may be fixed in the position assigned to it. G is the footboard; H H are splash leathers, which turn upon hinges, I I; and K K, steps attached to these leathers. L L are the doors, which are double folding, each door consisting of a large and small leaf, which are hinged together at M; the two larger leaves occupying the front of the carriage, and turning outwards on hinges at *m m*, and the two smaller leaves being brought when closed round upon the sides of the carriage, all as particularly shown in

* Bulletin de la Société de Mulhausen, vol. vii. p. 394.

Fig. 1.

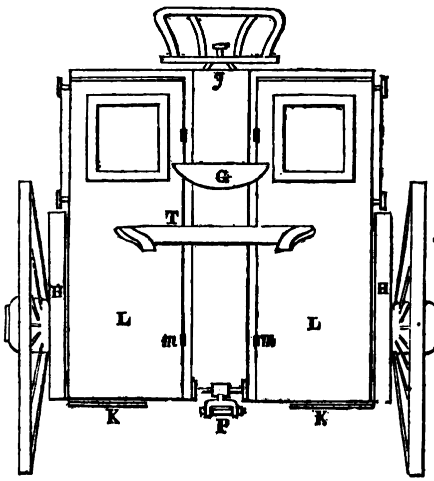
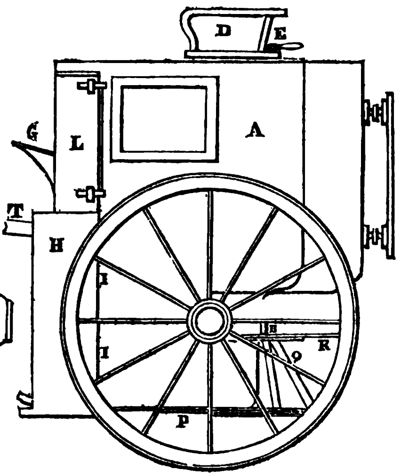


Fig. 2.



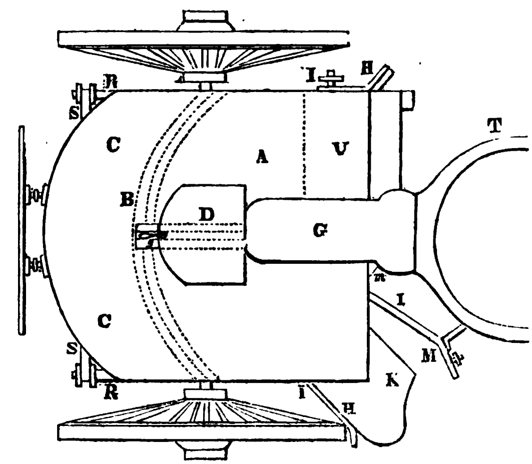


Fig. 3.

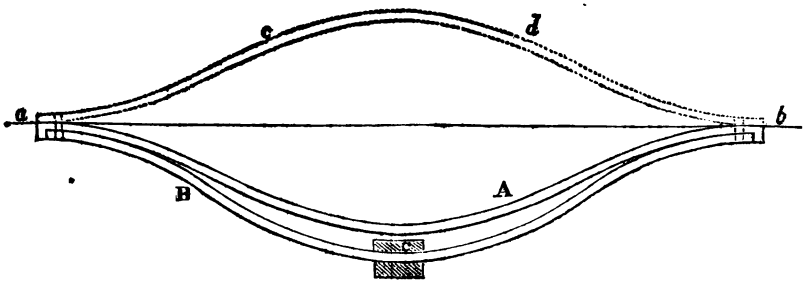
fig. 3, where one of the double doors is represented as thrown open, and the other as closed. P is a half spring, which supports the front part of the body, and is fixed to the axle by means of the frame Q. The back part is supported by half-springs, R R, and a cross spring S.

U is a flap seat, in the front part of the carriage for occasional use.

The mode in which the different parts of this carriage are arranged, seem to us judicious and skilful. It is manifestly a great improvement on the common cabs, and can hardly fail to come speedily into general use.

IMPROVED SPRING FOR RAILWAY AND OTHER CARRIAGES.

[Registered under the Act for the Protection of Articles of Utility.]

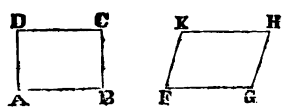


The spring represented in the above engraving, consists of two similarly curved steel plates, or bars, A and B, placed at a little distance apart, but firmly bound together at the ends. The greatest distance from a straight line *a b*, drawn between the ends of the spring and the plate A is 3 inches, and the like greatest distance from the same straight line and the plate B is 4 inches. The plate A is ¼ of an inch thick by 2½ inches broad; and the plate B ⅜ths of an inch thick by 2½ broad. But these are the dimensions adapted for good wagons carrying loads of two tons and upwards; and they must be diminished or increased in proportion to any diminution or increase in the weights to be sustained. Instead also of the parts A and B consisting of single plates of a given thickness, they may consist of two or more thinner plates, making up the given thickness between or amongst them. And further, instead of the two parts A and B being placed with their curves coinciding, the part A may be placed in the inverted part indicated by the dotted line *c d*. C is a hoop of iron attached to the centre of the part B for the purpose of receiving the spring-bearing pin.

From experiments which were made with a spring of this construction, 21 inches long, with a breadth of plates of 3 inches, it appeared that with a 56 lbs. weight, it vibrated freely, deflected only 1 inch and ¼, and returned to its original position on the weight being removed.

THEORY OF PARALLEL LINES.

Sir,—Your ingenious correspondent, Mr. Geo. Scott, when attempting in No. 1088 of your valuable Magazine to overcome the well-known difficulty in parallel lines, appears to me to have virtually assumed the whole affair, as I now beg to submit in the simplest manner.



Among Mr. Scott's diagrams we find two parallelograms, A B C D and F G H K, in which F G = A B, and G H = B C. The angles of A B C D are all equal, and they are supposed to be acute, whereas F G H and F K H are right angles. From such premises it is easily shown that the two remaining angles F and H of the second parallelogram should be still more acute than those of the first. This, indeed, though not in the easiest form, Mr. Scott himself has proved; for, on supposing angle G F K to exceed D A B, he finds that it leads to a contradiction. Now what I chiefly object to is, that from this result Mr. Scott immediately concludes that all the angles of both parallelograms must be right angles, although he has given no reason for, or proof of any such thing; and for aught I can see the very utmost which the above contradiction would entitle him to infer is that if angle D A B

be acute, it must exceed K F G. On this occasion, therefore, Mr. S. has done nothing for removing the difficulty. The curious method given by Mr. Meikle, in Jameson's Journal for April, and noticed in No. 1080 of your Magazine, comes incomparably nearer the mark. Because, anything which it might be alleged to contain of the nature of an assumption, can be easily shown to be less than the smallest part or fraction of Euclid's assumption which could be assigned.

K. L.

EXPERIMENTS FOR ASCERTAINING THE QUANTITY OF AIR WHICH ENTERS THE FIRE-PLACES OF THE CORNISH ENGINES, WITH OBSERVATIONS THEREON. BY ROBERT HUNT, ESQ.

[From the Eleventh Annual Report of the Royal Cornwall Polytechnic Society.]

*Part the Second.**

When the first part of this essay was submitted to the society, it was thought desirable that a few additional particulars should be obtained; and these the author now hopes he has it in his power to supply, in several instances.

As it respects the variable effects of the admission of larger or smaller quantities of air to the fires, on the duty of the steam-engine, the author has found it impracticable to ascertain. This could only be done by having the complete control of the engine for a few weeks, and the inconvenience which, it is stated, would probably arise from this, completely puts it out of the power of any one but an engineer to pursue with advantage *this* inquiry. I have learnt, however, from some of the most experienced engineers in Cornwall, that the admission of an additional quantity of air, with the view of increasing the rate of combustion, has not been followed with anything like a corresponding increase of duty; and, in some instances, an actual falling off in the duty of the engine has been the result.

The combustible burns fast or slow, according as it is supplied with air in greater or less rapidity. The *quantity* of heat developed by the same quantity of coal being always the same, and this we may indicate by 1000. Now if this heat is given out by supplying a given number of cubic feet of atmospheric air in five minutes, we should not if we supplied the same measure of air in three minutes increase the quantity of heat, although we increased the *intensity*. In the one case 1000° of heat were developed in three minutes, and in the other case in five minutes, from the same quantity of coals—*i.e.*, if the combustion is perfect. Now if we evaporate a given amount of water in five minutes, it will be found, under the same and the above circumstances, that we shall evaporate the same quantity in three minutes. Hence arises the question, which experience answers, is it economical for me to burn a bushel of coals in five minutes, or by quickening the combustion consume it in three minutes?

The more important question, however, is—If the volume of air admitted to the furnaces is *sufficient* to maintain the most favourable condition of combustion required by the Cornish engines? Experience has shown that the methods adopted by our engineers certainly ensures a sufficient quantity of air to the fire-places.

But it is not so clearly made out, that more than enough is not admitted; and with a view of ascertaining as correctly as possible this point, I have repeated the experiments of the former paper, with very great care. The disadvantages of admitting too much air, appears to be the cooling influence it exerts on the coals, in a state of low combustion, and at the same time on the boiler itself, robbing it of heat, and carrying it off through the flues to the stack.

It became desirable to know if the air, after it had passed the fires, still contained a sufficiency of oxygen to maintain combustion. The result of a great many experiments has shown me that a small quantity of *available* oxygen still remains in the air. In two quarts of ordinary atmospheric air, a taper burnt sometimes five times, and often six times as long, as it burnt in the air collected from the flues of the engines, at Tresavean and at North Roskear; but still a sufficiency of oxygen remained to keep up for a short time the *flame* of the taper, and to support, although faintly, a bright red wick when plunged into it.

These results are in accordance with the views entertained by Mr. West, who informed me that the largest duty was most economically and best done by the engine at North Roskear, when every aperture was carefully closed, and the air only admitted to the fires *very slowly* through the ash pit. On the first occasion in which I made my experiments at North Roskear mine, these conditions were very nearly complied with, and it was found that the air would only maintain the combustion of the taper for a second or two. More combustible bodies, as sulphur and phosphorus, of course, will burn in this air—the last abstracting the last portion of

* For Part First, see *Mech. Mag.*, vol. xxxix. p. 373.

oxygen—but carbonaceous bodies could not be maintained in a state of ignition, in an atmosphere in which phosphorus would vividly burn.

Recent endiometric experiments have shown, not only the correctness of my first results, but have already proved that the system adopted in the management of the fires gives a very constant result. Air collected but a few days since from the flues of the Tresavean engine, have given me 3, 3·03, 3·02, which will be found to be in strict accordance with the results obtained in August, 1842. The quantity of carbonic acid has also been invariably found to be in the proportion of one-ninth of the whole of the air escaping through the flues, and this result I had the satisfaction of having verified, by some very careful experiments, made by a gentleman at Cork, on a steam-engine, in which a similar method of combustion was adopted, as we have found to be so advantageous in this county, and which has been in many other places advantageously adopted.

Some objections were made to my mode of calculating the quantity of air which passes through the flues; particularly against my position, that the whole quantity of air passed on in a continuous stream, or nearly so, from the fire to the top of the stack. It was imagined that angles in some parts of the flues, and embayments in others, might give rise to counter currents. On this subject I have been very careful to consult some of the most experienced engineers in the county. They all express it as their opinion, that the air passes gradually and *entirely* onwards from the fire to the top of the stack. If we consider the question in its right light—or rather in what appears to me to be its right light—it will be evident that the case is very different from that of a stream of water running through a pool. In this case the running and the standing water are of the same temperature, and as the one is carried forward we know it creates eddies, and currents are formed at the edges, running in opposite directions.

Now in the flues and stack of an engine house, we have a column of air varying from 200° to 340° in temperature, ascending into an atmosphere the temperature of which is seldom above 70°. The ascensional force of such a column of heated air is easily calculated, and the varying rates at which it traverses the flues in different parts is not of difficult experimental solution. I long hoped I should be enabled to do this, and I proposed to adopt the plan suggested by Dr. Ure, which consists in introducing into the flues a syphon glass tube, which is partly filled with oil. Under the pressure of the atmosphere the oil would stand at the same heights in both arms; but if one arm is inserted into the flue, and carefully secured, whilst the other is exposed to the external air, the pressure being greater on the one than on the other, the hydrostatical equilibrium will be overcome, and an irregularity corresponding with the rate of the current of heated air will take place. The varying rates will be observed by the depressions of the oil in the external tube.

In my own furnace chimney I have been enabled to try this, and I have obtained a very satisfactory indication of the rate at which the air was passing. The difficulty, however, of getting leave to pierce holes into the flues and stack of an engine house, has been so great as completely to defeat my endeavours to pursue this line of investigation. It does, however, appear to me, that the time taken by a volume of smoke quickly formed in the fire-place to pass out at the top of the stack, gives an exceedingly nice approximation to the truth, and certainly affords us evidence of the passage of *a current*, with every evidence of its being an extensive one, in a given time. The results obtained in this have been strikingly corroborative of the correctness of my former results. At Tresavean I obtained as follows, 1′ 54″, 1′ 55″, 1′ 50″, 1′ 54″, 1′ 53″, 1′ 60″.

In conclusion it appears that but little improvement is to be made in the mode of admitting the air, or its quantity. It does appear that a slight excess is allowed to pass through the flues, but it is questionable if it is in the least injurious to the duty of the engine. It is, however, very desirable that trial should be made of admitting to the fire-places such air only as had been heated by passing along pipes, which could be very easily arranged in the flues.

THE FISHING BOATS OF CORNWALL.

[Abstract of a paper by Mr. Adams, read at the last meeting of the Royal Cornwall Polytechnic Institution.]

This paper commenced by giving an account of the boats and canoes in use among the natives of the South Seas, and of the coast of Africa; and then proceeded to give some historical notices of the introduction of fishing boats on the coast of Cornwall. The writer observed that Carew stated in his day, flat boards with sails were sent from the shore to tow fishing lines out to sea; and that the Irish used to come to Cornwall in wicker boats. The author then proceeded to speak of the state of the fishing boats within his own memory. He had seen boats that were built in the early part of the eighteenth century. Those of them built in

Mount's Bay and at St. Ives, had *round* sterns; while those built eastward of the Lizard had *square* sterns. Some of the large fishing boats built about the middle of the last century were now in being, and sea-going, both in Mount's Bay and St. Ives. It was not till early in the nineteenth century that builders attempted improvement, by giving to their boats a hollow run; that is, by making the boats hollow in the after part under water. They continued to increase the hollow part till about 1820, when they began to make the bows with a little less rake at the sterns, and thin under water in the foremost part, which occasioned a hollow bow and an unfair water line; a defect which the old builders could not be charged with. The only change for the better was the building of large and better accommodated boats for fishing, and an improved method of sailing them. In 1838, some boats were lengthened by the bow; but from lack of science, the new part of the bow was made too small, and the luff of the bow left too big, which caused an inverted water-line that could not but impede the boat's progress. But still the boats sailed faster, and shipped less water, than when the old bow was bluff. Since 1838 there had been a gradual improvement in the bows. Instead of a hollow water-line, builders had endeavoured to produce a straight one; but they had failed, though in a less degree. The author proceeded to state that he had induced many of the best-informed builders in his neighbourhood, to approve of and adopt the system of elliptic or circular water-lines; and those boats whose water-lines approached nearer to a segment, had invariably proved superior to those of the old model. The author then described the fishing boats of Mount's Bay, and the *yawls* on the N.W. coast of Cornwall, which were said to row and sail fast, and to be perfectly safe and manageable under oar or sail. He then described successively the peculiarities in the build and sails of the boats west and east of the Lizard, at Falmouth, Mevagissey, Fowey, St. Agnes, Newquay, Padstow, and Scilly. The sea boats were next described; and he remarked generally of the fishing boats of Cornwall, that they were built flatter in the bottom than those used more to the eastward; they were consequently more buoyant and capacious than the sharp-built boats of Dover and its neighbourhood, and better adapted to our harbours. They were also equally as manageable and as safe as those of any part of Great Britain of the same size. The author then enforced, by natural illustrations, the argument that all bodies designed to pass through air or water with velocity should be so far spherical as their dimensions will admit. He then urged the propriety of building boats upon an even keel, and with the fore and aft parts as much alike as possible. He next spoke of the necessity, in modelling boats, of considering the nature of the harbours and seas for which they are destined, in order to adapt the flatness or rising to the respective situations, and the buoyancy and capacity to the employment; the rising varying on a 10-feet beam from 5 to 8 inches. The breadth of a rowing boat should not exceed a quarter of her length, and her depth not more than half her breadth; while her longitudinal water-lines should be segments from end to end. Her dead-flat or widest part should be in the middle of the length; and if there were a flat stern, it should be placed above the water-course. Sailing boats required greater breadth and depth in proportion to their length than rowing boats; the increased *breadth* to sustain the side pressure of the sails, and the greater depth on account of their yielding to the sails. The floor must have a rising suitable to the employ; the futtock a full bold sweep; little or no rake at the stern-post; keel but little short of the whole length aloft; the dead-flat placed on the keel 25·60ths of the extreme length from the forepart of the stern. All the water-lines should be segments of circles as nearly as possible. This paper was illustrated by a drawing of a sailing and rowing boat.

MODE OF COLOURING DAGUERREOTYPE PICTURES. BY PROFESSOR PAGE, OF COLUMBIA COLLEGE, WASHINGTON.

In the month of December, 1842, I instituted a course of experiments to determine the effects of oxidation upon the surface of Daguerreotype pictures, and arrived at some beautiful results in fixing, strengthening, and colouring these impressions. Numerous and arduous duties of a public nature have prevented me from investigating the subject as I wished, and I therefore present the facts for others to adopt as the basis of what promises to be a most interesting course of study and experiment.

First, a mode of fixing and strengthening pictures by oxidation:—

The impression being obtained upon a highly polished plate, and made to receive, by galvanic agency, a very slight deposit of copper from the cupreous cyanide of potassa, (the deposit of copper being just enough to change the colour of the plate in the slightest degree,) is washed very carefully with distilled water, and then heated over a spirit lamp until the light parts assume a pearly transparent appearance. The whitening and

cleaning up of the picture, by this process, is far more beautiful than by the ordinary method of fixation by a deposit of gold. A small portrait fixed in this way, more than a year since, remains unchanged, and continues to be the admiration of persons interested in this art. One remarkable effect produced by this mode of fixing, is the great hardening of the surface, so that the impression is effaced with great difficulty. I have kept a small portrait thus treated, unsealed and uncovered for over a year, and have frequently exposed it in various ways, and rubbed it smartly with a tuft of cotton, without apparently injuring it; in fact, the oxidized surface is as little liable to change as the surface of gold, and is much harder. As copper assumes various colours, according to the depth of oxidation upon its surface, it follows that if a thicker coating than the first mentioned can be put upon the plate without impairing the impression, various colours may be obtained during the fixation. It is impossible for me to give any definite rules concerning this last process, but I will state, in a general way, that my best results were obtained by giving the plate such a coating of copper as to change the tone of the picture, that is, give it a coppery colour, and then heating it over a spirit lamp until it assumes the colour desired. I have now an exposed picture treated in this way at the same time with the two above mentioned, and it remains unchanged. It is of a beautiful green colour, and the impression has not suffered in the least by the oxidation. Should this process be perfected, so as to render it generally available, it will be greatly superior to the present inartistical mode of stippling dry colours upon the impression; for the colour here is due to the surface of the picture itself. For pure landscapes, it has a pleasing effect, and by adopting some of the recent inventions for stopping out the deposit of copper, the green colour may be had wherever desired. In some pictures a curious variety of colours is obtained, owing to the varying thickness of the deposit of copper, which is governed by the thickness of the deposit of mercury forming the picture. In one instance a clear and beautiful ruby colour was produced, limited in a well-defined manner to the drapery, while all other parts were green. To succeed well in the first process, viz., that for fixation and the production of the pearly appearance, the impression should be carried as far as possible without solarization, the solution of the hyposulphate of soda should be pure and free from the traces of sulphur,* the plate should be carefully washed with distilled water, both before and after it receives the deposit of copper, in fact, the whole experiment should be neatly performed, to prevent what the French significantly call *taches* upon the plate, when the copper comes to be oxidized.—*Franklin Journal, May*, 1844.

* The presence and deposit of sulphur, is a fault of most of the hyposulphate of soda of commerce, and it is the action of this sulphur upon the silver, that puzzles so many daguerreotypers, by clouding, staining, and marking the plates in various ways. It may be obviated by repeatedly filtering the solution, or by keeping it in lightly corked bottles a long time before it is used.

In addition to the above I may state that exposure, of the coppered picture, to the vapour of hydrosulphuret of ammonia, produces sometimes a pleasing effect, but usually spoils the impression.

FLEXURE OF BEAMS LOADED VERTICALLY. REPORT BY MM. PONCELET AND LIONVILLE, COMMISSIONERS APPOINTED BY THE FRENCH ACADEMY OF SCIENCES ON A NOTE ON THIS SUBJECT PRESENTED BY M. LAMARLE.

In this note M. Lamarle has chiefly proposed to establish the following principles:

1. The loads, which beams, loaded vertically, can support without permanent alteration, are independent of their lengths, and simply proportional to their sections, so long as the ratio of their lengths to the least dimension of their transverse section does not reach a certain limit.

2. Beyond that limit, and in all cases of practical application, the maximum load may reach, but can never exceed, the pressure corresponding to the initial flexure .

M. Lamarle also shows that (the pieces being supposed prismatic,) it is sufficient to know the greatest change in length compatible with the preservation of elasticity, in order to determine numerically the limit alluded to. He remarks beside that the results furnished, by calculation, accord with the facts generally observed, and that they imply the consequences announced by M. Duleau, in the following terms: "A rectangular bar pressed vertically, resists until the compressing weight attains the value, $Q = \frac{\pi^2 c}{4 a^2}$. This weight causes the piece to assume a curvature in the direction of its smallest dimension, and it at once folds together." The deductions of the author rest essentially upon the analysis given by M. Lagrange, for the problem of the flexure of pieces loaded vertically, but by imposing the condition of not surpassing the force capable of producing a permanent alteration, and by expressing this condition numerically, M. Lamarle has introduced into the question an element of which advantage had not yet been taken to solve it practically. The introduc-

tion of this element fixes the degree of convergence of the series which are obtained, and permits the deduction from the general solution, of rules valuable to the builder.

We know, and Lagrange has proved, that the flexure of pieces pressed vertically, becomes possible only when the pressure has obtained a certain minimum value. If the pieces are prismatic, the load corresponding to the initial flexure, increases in the inverse ratio of the squares of their lengths. The contractions which it produces, independent of all flexure, are, therefore, more considerable in reference to the unit of length, in proportion as the pieces are stouter, and we may conceive that for a given cross section there exists always a length below which there is already an alteration of elasticity, even when the load is too small to cause a commencement of flexure. Hence the first principle announced by M. Lamarle.

Let us now consider the case of flexure, and let us suppose the ratio of the length to the smallest dimension of the cross section to be so great, that flexure may commence before a permanent alteration has taken place. In this case the strain *due to the effect of flexure alone*, increases as the versed sine; and M. Lamarle shows that an almost imperceptible increase of the pressure corresponding to the initial flexure, is sufficient to cause an instant alteration of the elasticity. Hence the second principle of the author, not absolute, but sufficiently general to include all the cases which might escape the first, under the circumstances usual in practical applications.

These two principles taken together, offer a satisfactory solution to the question of beams loaded vertically.—*Comptes Rendus, 15th January*, 1844.

WIRE AND HEMPEN ROPE.

The following Table has been circulated by Mr. Smith, the patentee, of a particular description of wire rope, as being "founded on careful and repeated tests made by the Lords Commissioners of the Admiralty," and as demonstrating the superiority of wire rope over hempen rope or chain:—

Breaking strain of each.		SIZE. Circum. of wire rope.	Circ. of hemp rope.	Diam. of chain.	WEIGHT PER FATHOM. Wire rope.		Hemp rope.		Chain.
T.	*C.*	*In.*	*In.*	*In.*	*lb.*	*oz.*	*lb.*	*oz.*	*lbs.*
6	7	2	5	½	3	14	6	0	16
12	0	3	8	13—16	8	8	14	3	36
19	6	4	10	31—32	14	7	25	0	53

THE LIGHTNING CONDUCTOR OF THE ROYAL EXCHANGE.

Sir,—In the *Mechanics' Magazine* for August 31, is a letter from Mr. Baddeley, condemnatory of the plan I have adopted for the lightning conductor of the New Royal Exchange. Your correspondent says of himself, "Not being very deeply versed in electrical science, it has occurred to me that I may probably be mistaken," &c. If such were his impression, he has acted very indiscreetly, to say the least, in stating, "it seems to me that the tower is in more imminent peril from the presence of the conductor, than it would be if that appendage were away." If he doubted his ability, as he implies he does, to form a competent opinion on the matter, it became him either to hold his peace, or else to read up and make himself master of the subject, before thus venturing to pronounce judgment on the works of those who are presumed to be somewhat versed in the science. Gratuitous opinions of this kind are the fertile source of much mischief, and the public have good reason to complain against those who put them forth.

I shall not trespass on your valuable pages in refutation of your correspondent's opinions. If he will be at the pains to consult Gay Lussac's "Instructions sur les Paratonnerres," in the 26th vol. of the Annales de Chem. et de Phys.; Arago's treatise "Sur le Tonnerre," in "Le Bureau" of 1838; Mr. Snow Harris "On Thunderstorms;" together with several memoirs by myself and by Mr. Harris, in Nos. 6, 7, and 8, of the proceedings of the Electrical Society, and will then examine the arrangements at the Royal Exchange, he will find that every precaution which science can suggest has been taken, and that his fears for the safety of "this fine building" are all imaginary.

In a popular article "On Lightning Conductors," written by myself for the April number of the London Polytechnic Magazine, he will find a few words in reference to the *insulation* on which he lays so much stress.

With respect to the diameter of the conducting-rod, I may mention that it exceeds the standard for such a tower by one-eighth of an inch. But all these matters will be fully described in a notice which I hope to publish, as soon as all the details of the conductor shall be completed.

Should your correspondent be curious to inform himself of the manner in which the usual uninsulated conductors act when conveying a lightning flash, I would further refer him to a collection of cases by Mr. Harris, which is now in the press, and will appear in the October number of the *Electrical Magazine*.

I trust these few observations will allay any fears which Mr. Baddeley's letter may have conjured up in the minds of your unelectrical readers.

I am, Sir,

Your very obedient servant,

CHARLES V. WALKER.

Westbourne Green.
Sept. 5, 1844.

THE VESTA LAMP.

Sir,—In your Monthly Part just received S. B. J., Peckham, complains that he cannot use his Vesta Lamp. Now, having used one regularly for six months, with the greatest satisfaction, without its smoking *once* during that time, (unless carelessly turned up too high) I can only conclude, that the lamp complained of must be badly manufactured, or the camphine of an *inferior* quality; let him get a good lamp and try English and Watson's camphine, sent out in tin cans, secured with Betts's metallic capsule, and he will have no reason to complain.

I am, Sir, yours respectfully,

EDWARD G. SELF.

Dorchester, September 3, 1844.

NOTES AND NOTICES.

Improvement in the Atmospheric Railway.—At the last annual meeting of the Royal Cornwall Polytechnic Institution, a model of an atmospheric railway was exhibited by C. Roberts, Esq., in which were several new arrangements, particularly of the valve; it ascended an incline of one in twenty with ease, and several gentlemen took a trip on it—this is a gradient which cannot even be attempted by any railway engine yet introduced. Instead of using a heated iron for the purpose of dissolving the composition to seal the valve, Mr. Roberts uses a vertebrated valve. By employing larger receivers, in proportion to the size of the propulsion tube, he expects to be able to procure more rapid exhaustion, and to close the valve, and start the train at a moment's notice.—The Judges awarded Mr. Roberts the society's silver medal for the invention.

The Stars.—A very remarkable discovery has recently been made by M. Bessel, of Konigsberg, which opens out new views of the constitution of the sidereal universe. By a long and laborious examination of the places of Sirius and Procyon, as deduced from the observations of different astronomers since the year 1755 (the epoch of Bradley's observations), including his own, carried on at the Konigsberg Observatory, he has come to the conclusion that the *proper motions of these two stars are not uniform*, but deviate from that law,—the former in right ascension, and the latter in declination, in a very sensible degree. Astronomers will at once perceive the importance of this conclusion, which proves that the stars describe orbits in space, under the influence of dynamical laws and central forces. Reasoning on the observed character of the deviations which he has established, M. Bessel comes to the singular and surprising conclusion, that the apparent motions of these two stars are such as might be caused by their revolutions about attractive but *non-luminous* central bodies, not very remote from them respectively; that, in short, they form systems analogous to those of the lunary double stars, but with this peculiarity—that they have dark, instead of bright partners, to which they of course perform the friendly office of revolving suns!—*Athenæum.*

Elongation of Ships' Bows. — Previous to the departure of the *Fox*, 42, frigate, Capt. Sir H. M. Blackwood, Bart., now on her passage to the East Indies, 12 feet were added to her bows, under the direction of Mr. White, of Cowes, the builder and restorer of the celebrated 10 gun brig *Waterwich*; and this alteration has so improved her sailing that she runs 11½ miles an hour under royals, and only one point from the wind. It would appear that the Admiralty are so satisfied with the success of this experiment, that they have ordered Mr. White to alter the bows of the *Amphion*, 36, frigate, at Woolwich, in a similar manner. The bows of the *Amphion* will be lengthened 16 feet, as she is a larger vessel than the *Fox*. The *Amphion*, as we stated some time ago, is to be fitted with auxiliary steam-engines of 300 horse-power.

A Cheap Paint.—Take one bushel of unslaked lime and slack it with cold water; when slacked, add to it twenty pounds of Spanish whiting, seventeen pounds of salt, and twelve pounds of sugar. Strain this mixture through a wire sieve, and it will be fit for use after reducing with cold water. This is intended for the outside of buildings, or where it is exposed to the weather. In order to give a good colour, three coats are necessary on brick, and two on wood. It may be laid on with a brush similar to whitewash. Each coat must have sufficient time to dry before the next is applied. For painting inside walls, take as before, 1 bushel of unslaked lime, 3 lbs. of sugar, 5 lbs. of salt, and prepare as above, and apply with a brush. I have used it on brick, and find it well calculated to preserve them: it is far preferable to oil paint. I have also used it on wood, and ascertained that it will last longer on rough siding, than oil paint will on plained sidings or boards. You can make any colour you please. If you wish straw colour, use yellow ochre instead of whiting; for lemon colour, ochre and chrome yellow; for lead and slate colour, lampblack; for blue, indigo; for green, chrome green. The different kinds of paint will not cost more than one-fourth as much as oil paints, including labour of putting on.—*Ontario Freeman.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1101.] SATURDAY, SEPTEMBER 14, 1844. [Price 3*d.*

Edited by J. C. Robertson, No. 166, Fleet-street.

THE PERIPHAN, OR IMPROVED PLANETARIUM.

Fig. 1.

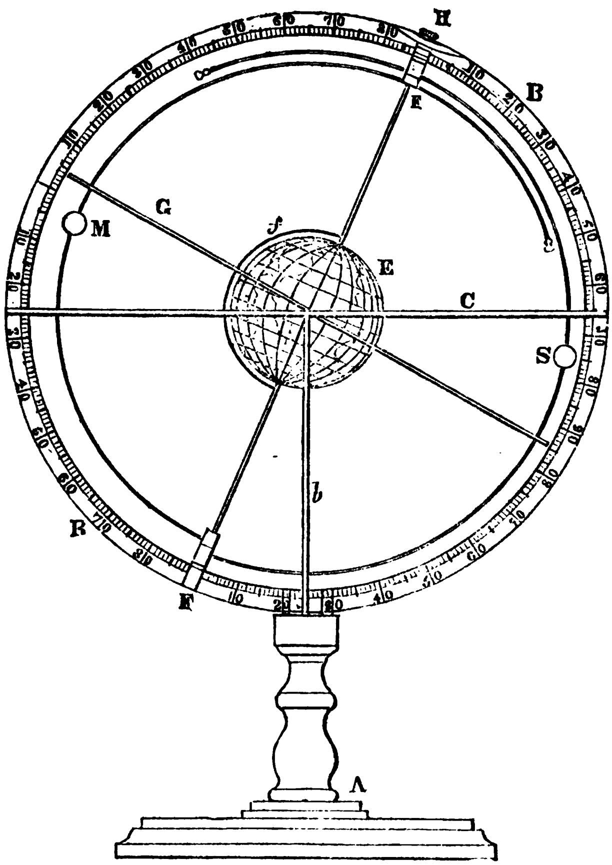
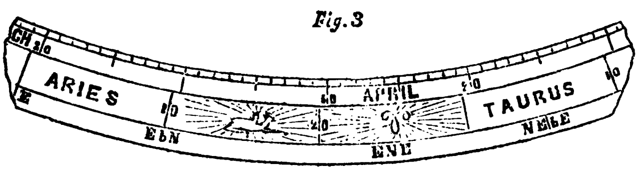


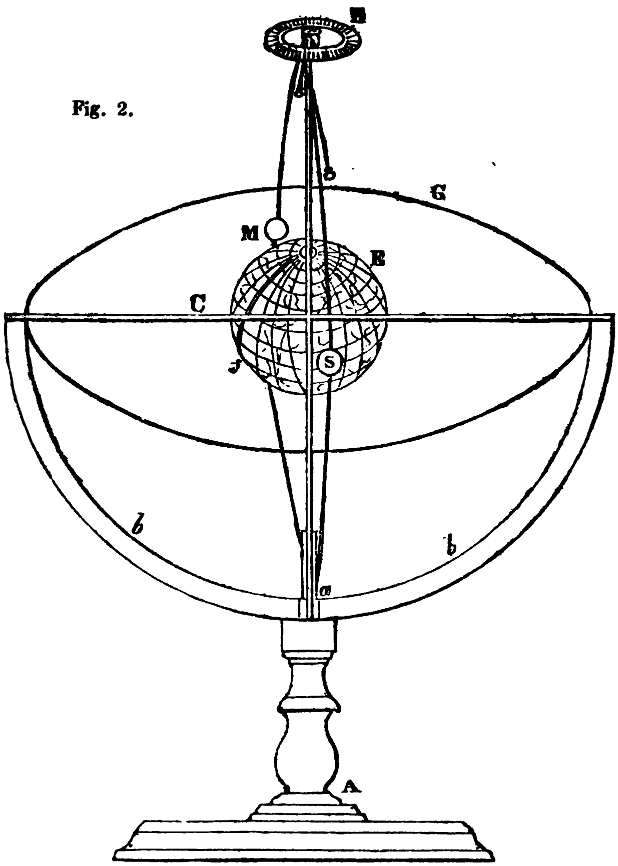
Fig. 3



THE PERIPHAN, OR IMPROVED PLANETARIUM.

[Registered under the Act for Protection of Articles of Utility. Mr. Richard Baker, of Weymouth, Inventor and Proprietor.]

Fig. 2.



The instrument which forms the subject of our present notice differs in several essential particulars from all the contrivances of the sort which we remember to have seen, and is calculated, we believe, better than any of them, to facilitate the acquirement of clear and correct notions of the mutual relations of those of the planetary bodies, which come more immediately within the sphere of our mundane observation. To every school and academy where a knowledge of the heavens forms a part of the course of study —and to that best of all schools especially, the *home* school—it must be a great acquisition. The instrument is appropriately called the Periphan (from the Greek περιφαντος) on account of the peculiarly lucid manner in which it illustrates various celestial phenomena.

Fig. 1 is an elevation of the instrument, and fig. 2 a second elevation in a different plane.

A is the pedestal of the instrument. B is a meridian ring, which is stepped at bottom in a boss, let into the top of the pedestal shaft, so as to be permanently immoveable. C is a horizontal ring, which divides the meridian ring B into two equal parts, and is supported partly by two arms *b b*, which spring from the boss and partly by bearings in the

ring C. The meridian ring is graduated on one side in a manner similar to the brass meridian of the common globe; but on the other side (that not seen in the figures) the upper quadrants are graduated from different points, that is to say, the numbering commences at the intersection of the horizontal ring C, and terminates at the celestial north pole, or 90°. The horizontal ring C has engraved on its upper surface the zodiacal signs, months, days, &c., in a manner similar to the wooden horizon of the common globe, only that they are arranged somewhat differently, as exemplified in the top view of a part of this ring given separately in fig. 3. E is a terrestrial globe, placed in the centre of the sphere, which turns freely on a fixed axis F F, and is kept in its central position by a pin inserted into the axis immediately below the semicircular ring *f*, which half encircles the globe. S and M are two globes representing the sun and moon, which slide freely on circular arcs of wire, which are attached at bottom to the axis F of the terrestrial globe E, and pass through the same axis at the top to the extent shown, these arcs turning also freely in their bearings; so that the globes S and M can be placed at any point required opposite the inner edge of the horizontal ring C. G is a circular ring, which turns on bearings attached to the horizontal ring, and serves to describe the horizon for any latitude (the horizontal ring C, which is usually employed for that purpose, being in this instrument applied to other uses). H is a horary circle fixed on the top of the axis of the earth, E.

Two of the most striking features of novelty in this ingenious instrument are the circular arcs on which the orbs representing the sun and moon move. The convenience of this arrangement will be obvious to every one at all familiar with the use of the globes. It must be observed, however, that that arrangement would not be quite complete—and indeed might possibly lead to misconception—were there not a small appendage to the instrument, which is not represented in the engravings. We refer to a small strip of brass, about the eighth of an inch wide, and four or five inches long, which is made to screw on and off the sun, in order to represent the ecliptic in its apparent diurnal motion. When in the solution of any problem it is required to show the angle which the ecliptic makes with the horizon when the sun rises and sets, all that is necessary, is to fix this strip of brass in a position parallel to the ecliptical ring, when the sun is put in its proper place for the given day.

ALLIOTT'S PATENT SCOURING, BLEACHING, AND DYEING MACHINE.

Fig. 4.

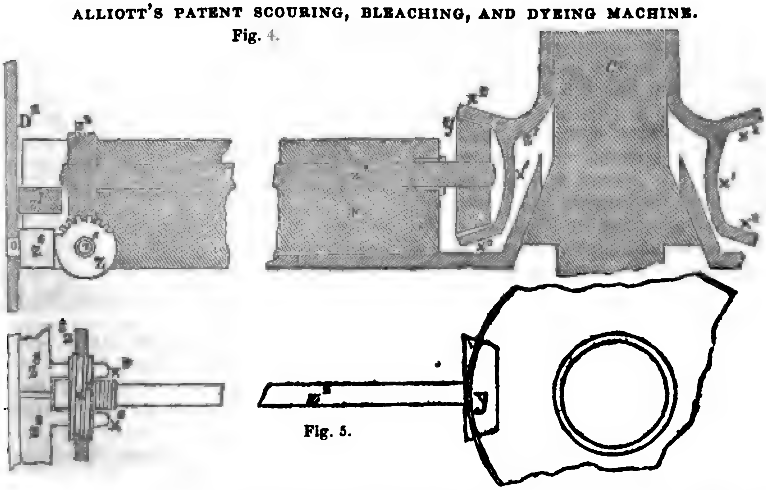


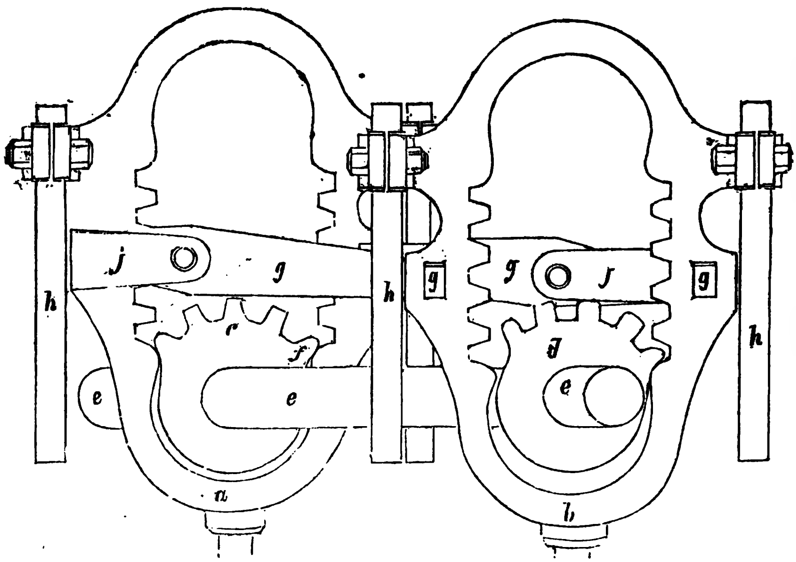
Fig. 5.

The above are the engravings which were omitted to be given with the description of this invention inserted in our last Number; they represent a part of the apparatus, which is exceedingly ingenious, and well deserves the notice of the intelligent mechanician.

LIPSCOMBE'S PATENT SUBSTITUTE FOR THE CRANK.

[Patent dated August 17, 1843; Specification enrolled, February 17, 1844.]

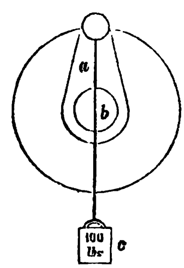
Fig. 7.



There is much diversity of opinion existing regarding the crank as a circular transmitter of power, some averring that there is a great misdirection of force by its use; whereas, others, and these are by far the most numerous, strenuously maintain that there is no misdirection of power whatever, but that the crank faithfully transmits in a circular direction the whole of the force expended against it. It is rather singular that the opinion should be so general as it is, when a single glance at the crank in motion, manifests at once, that its action is essentially oblique; and it is well known, that in all cases of oblique action there must be a misdirection of power, when it is desired that the transmission of power should be in one direction only. Now, the crank is only required to transmit force in a circular direction, consequently, there must be a misdirection of power. The following very simple experiments, which any one at a trifling expense may try, clearly prove that the crank does not transmit even so much as half the power expended against it.

Fig. 1 represents the crank *a* in a right line with the crank-shaft *b*, and the gravitating force of the weight *c*; it will

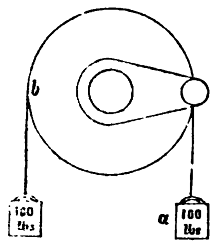
Fig. 1.



at once be seen that the crank has not the slightest tendency to move either to the right or left, which clearly proves that the whole gravitating force of the weight is exerted in pulling the crank shaft against its bearings, thereby showing a misdirection of force of 100 lbs.

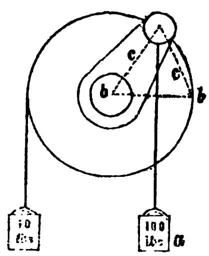
Fig. 2 shows the position of the crank at half stroke; a weight of 100 lbs. hung at the extremity of the crank exactly balances a similar weight hung upon the wheel *b*, which is of precisely the same diameter as the crank circle; this clearly

Fig. 2.



proves that the whole gravitating force of the weight *a* is transmitted by the crank solely in a circular direction, thereby showing that no misdirection of power exists in the crank while in this position.

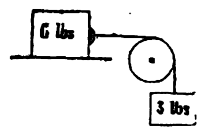
Fig. 3.



The average misdirection of power by the crank will therefore be, when the line of the gravitating force of the weight *a* (fig. 3) is exactly midway between *b* and *b*; it will be observed in this figure, that only one half of the gravitating force of the weight is expended in turning the crank, the other half being wholly exerted in pulling the crank-shaft against its bearings (the dotted lines express this division of force); this is proved by the crank being able to transmit the force of only 50 lbs., *d*, at a tangent from the crank circle, although the force expended at the extremity of the crank is 100 lbs.: the weight of 50 lbs. is represented as balancing the 100 lbs.

The misdirection of 50 lbs. out of every 100 lbs. by the crank is not the only loss sustained; this average misdirected force, by pulling the crank-shaft against its bearings, creates friction, which has to be overcome by the power which is being transmitted in a circular direction. We will now calculate the friction produced by this average misdirected force. It is well-known that a hard smooth body, say of 6 lbs. weight, resting upon a perfect plane, cannot be made to slide, unless a force equal to a suspended weight of a little more than 3 lbs. is exerted against it, in a direction parallel with the plane, as in fig. 4. It will thus be seen, that

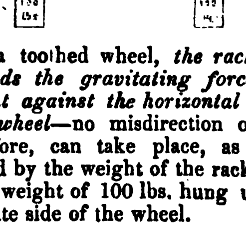
Fig. 4.



to produce a sliding motion in a body requires a force a trifle more than half that which would lift it. Now one body rolling in another (as in the case of the crank shaft rolling in its bearings,) is simply a sliding motion; if, therefore, the diameter of the crank shaft at its bearings, were exactly equal to that of the crank circle, it would take a little more than 25 lbs. to overcome the friction, produced by the misdirected force of 50 lbs.; but as the diameter of the crank circle, we will suppose, is four times greater than the diameter of the crank shaft at its bearings, only $\frac{1}{4}$ of 25 lbs., that is, $6\frac{1}{4}$ lbs. is requisite for the purpose. *The average available force of the crank is thus shown to be* $43\frac{3}{4}$ lbs. *whereas, the power wasted is* $56\frac{1}{4}$ lbs.

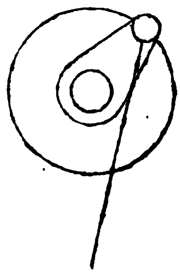
Compare the crank motion with a wheel and rack motion. Fig. 5 represents a rack weighing 100 lbs. gearing

Fig. 5.



into a toothed wheel, *the rack always expends the gravitating force of its weight against the horizontal teeth of the wheel*—no misdirection of force, therefore, can take place, as is fully proved by the weight of the rack balancing a weight of 100 lbs. hung upon the opposite side of the wheel.

Fig. 6.



Although the greatest leverage of a crank worked by piston is one-third more than would be the leverage of a toothed wheel worked by the same piston, yet this advantage is counterbalanced by being compelled to travel over one-third more space in the same instant of time than the wheel.

A force of 56¼ lbs. out of every 100 lbs. has been shown to be wasted by the crank; a *further waste* will be shown to ensue *by the use of a connecting-rod*, which every one conversant with the steam-engine knows to be a necessary appendage to the crank, except in those engines having oscillating cylinders—this waste being produced by its oblique action, a greater obliquity existing when a short rod is used than when a long one is employed. Thus, in a connecting-rod three times the length of a crank, there is an average misdirection of one-sixth the whole force exerted by the piston-rod against it, and if four times the length of a crank, then the average waste is reduced to one-eighth. The average force required to overcome the friction produced by the side pressure of the connecting-rod against the piston-rod and crank will be one-half the whole force misdirected by the connecting-rod; the total waste, then, by the short connecting-rod is one-fourth the whole power expended against it by the piston-rod. *The combined average waste of the crank and connecting-rod* (supposing the latter three times the length of the former,) *for every* 134 lbs. *expended by the piston-rod, will stand thus:*

Waste by connecting-rod 34 lbs., *which gives the pressure against the crank of* 100 lbs.; *the crank out of this wastes* 56¼ lbs., *leaving an available force of only* 43¾ lbs., *or rather less than one-third of the whole.* This will undoubtedly be startling, but try the experiments and make the calculations yourselves. Those who attentively observe the small amount of power given out by our locomotive, stationary, and marine engines, compared to what should be given out, can scarcely fail to be impressed with a notion, that an immense deal of power is in some way or other unnecessarily wasted.

Very false notions have been conceived with regard to the crank; indeed, so much so, that those who express suspicion as to the utility of the crank are ridiculed for their ignorance. Russell, in his work upon the steam engine, has entered very largely into this subject, and his views, which are exceedingly favourable to the crank, have been repeatedly quoted by its advocates, and unfortunately with *too* much effect; but the views of that author are extremely erroneous. He has throughout laboured under the impression that the force transmitted against the crank is *always at a tangent from the crank circle*, and has given a table (page 241) showing, as he says, the average per centage of pressure transmitted by the crank in a circular direction, compared with that against the piston at the same instant of time. This table would be correct were the whole force expended against the crank *always at a tangent from the crank circle;* but we all know this can only take place at *one* instant of time at every stroke. The most prejudiced, therefore cannot fail to observe how that author has been led astray.

The high results which experimentalists have given of the available power of the crank engines, as compared with the steam pressure upon their pistons, were possibly produced by working the engines for a little time, and then testing their available force; but this method would be manifestly incorrect, as the engine will have acquired momentum from the power applied previously. At all events, gross miscalculations have in some way or other been made. The simplest and best method of testing the crank, is in the way shown by the preceding figures.

The present patentee, having from his experiments ascertained the disadvantage of employing the crank, invented and patented a substitute of which the following is a description.

It will be seen from fig. 7, that each of the piston rods, *a* and *b*, terminates in

a rack; these racks are prevented from swerving by the four guides *h*, and gear into the spur segments *c* and *d*, both of which are keyed to the shaft *e*. The piston rack *a* is seen quite at the end of its stroke, while the piston rack *b* is seen a little way in its downward stroke; it will be observed, that the segment *d* is keyed to the shaft with a greater inclination upwards than segment *c*, thereby effectually *preventing both pistons being at the end of a stroke at the same time*. Now, imagine the shaft to be revolving, and the rack *b* driven against the segment *d*; the other segment *c*, having just left one side of the rack, gets its tooth *f* in the other side before the piston rack can rise sufficiently to prevent its doing so; but to prevent a possibility of either of the racks overtaking and preventing the segment teeth gearing properly with the racks at the commencement of a stroke, the racks are connected together by two levers *g*, each rack having a projection *j*; for each lever to take its bearing, one end of each lever is inserted in a slot in one rack, and the other end in a slot in the other rack as shown: the lever ends are allowed a little play in their upward and downward movement.

To understand the action of these levers it will be necessary to imagine the engine at rest; now if steam is admitted in that cylinder containing the piston of the rack *a*, the rack will rise so as to bring its tooth into the dotted position just below the segment tooth *f*; the play allowed at the ends of the levers will permit it to rise thus far, but no farther, *unless it likewise raises the other rack*, by doing which, it turns the shaft and both segments; the tooth *f* then slips inside the rack without a possibility of the rack preventing it.

There is this peculiarity observed in a rack working in an open segment—the more fairly a tooth of a segment is in a rack, the less is the amount of play between that tooth and the teeth of the rack; so that although there is comparatively a great deal of play between the outer teeth of a segment and the rack teeth at the commencement of a stroke, that amount of play decreases very much at the instant a segment inclines from one side of a rack to the other; this decrease of play has the effect of *discontinuing* the action of the levers immediately each segment has a tooth fairly in the side of a rack. Thus, when the segment tooth *f* is as fairly in its rack as in the corresponding tooth of the other segment in the rack *b*, *the action of the levers will have discontinued.*

It may be objected that the concussion at the commencement of every stroke would be so great, as to break the teeth of either the segments or racks; but it must be recollected, that a piston at the commencement of a stroke has great resistance to overcome; it has the counteracting efforts of the escaping steam to overpower, which at that time is considerably more powerful than at any other point of a stroke; it has its inertia and its friction against the cylinder to overcome; these circumstances together, would tend to retard the movement of the piston just at the commencement of a stroke, so that its velocity would be about equal to that of a segment, and thus prevent any injurious concussion; at all events, a suitable arrangement of the slide valves could easily accomplish this. When once the teeth of a rack arrive in contact with one of the teeth of both segments, no after concussion during a stroke need be apprehended: fewer, and consequently stronger teeth may be used when a rack gears into a toothed wheel, than when one toothed wheel gears into another; all danger of breakage of the teeth could therefore be easily obviated.

By using this substitute *instead* of a crank, the *saving* may be safely stated as *more than three-fourths the first cost, the weight of an engine three-fourths less, occupying less than one-fourth the space, and consuming less than one-third the quantity of fuel.*

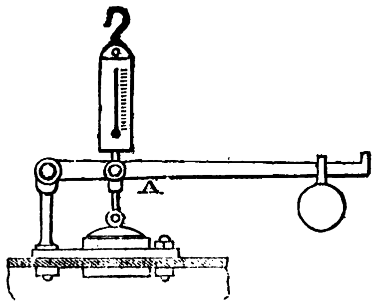
N.

READY MEANS OF TESTING THE PRESSURE ON SAFETY VALVES.

Sir,—From the circumstance of having had occasion to attend an inquiry into the causes of a steam boiler explosion of a very serious nature in this neighbourhood, I take the liberty of offering a suggestion, through the medium of your most valuable publication, on a ready means by which I propose testing the actual pressure upon the safety valve, or rather the power required to lift the valve, and which may be of assistance to those immediately attending upon steam-engines and boilers, more particularly the firemen or stokers, who, unfortu-

nately, are generally men of little or no education.

Suppose a safety valve made, as is most common, with weights, lever, and spindle, resting upon the valve, thus—



I would then propose (where "Salter's spring balance" is not already attached to the end of the lever) to apply the balance to the point A. You have then nothing to do but stretch the balance by hand, or by lever, until it lifts the valve (the steam being down at the time); then see where the pointer stands at on the graduated plate of the balance, and the number will indicate the gross pressure, including friction from bad levers, joints, &c., of steam required to lift the valve. Should it be desired to know the pressure per square inch, multiply the square of the diameters of the valve by 7854, and divide the product by the figure at which the pointer stands on the balance.

My main object in bringing this before your notice, is, if possible, to prevent in some measure the melancholy occurrences that so frequently happen from want of a knowledge of the actual pressure to which boilers are subjected. One balance would answer for any number of safety valves, and might be kept, when not in use, in possession of the master or head engineer.

I remain, Sir, your obedient servant,

W. R.

Manchester, September 7, 1844.

LIGHTNING CONDUCTORS.

Sir,—I know not who is the projector of the lightning conductor attached to the Royal Exchange; or whether my principle has been adopted. I shall continue, however, to describe my invention and leave the subject to public decision, premising, merely, that more than *fifty* of these lightning conductors have been erected in various parts of the country, and some of these have stood the test of *twenty* years. In proving that my lightning conductor contains all the elements of a sound induction, I may safely appeal to the scientific electrician.

A good conductor should be pointed, for the easy receipt of the meteor; should be of a sufficient capacity to meet the case of a vast accumulation of electricity; should be formed of a material of the best conducting character; be continuous, to allow the uninterrupted descent of the lightning to the earth—and further, safely deposit the meteor in the subsoil.

In accordance with the premises, let it be remembered, that *copper* is, next to silver, the best conductor of electricity among the metals — that electricity in its transit does not pervade the interior of the metal, and permeates only to an inappreciable depth—and that a rounded and smooth surface preserves best the attachment of electricity, while points and edges, or angles, facilitate its escape.

I will now venture to describe the structure of my lightning conductor, and it will be seen, that all these conditions are secured. It consists of copper gas piping screwed together in definite lengths; the terminus at top consists of a solid copper pyramid screwed also into the piping. Immediately beneath the socket the copper piping is perforated with a

circular row of orifices, and thus the internal as well as the external surface is provided, as a conducting medium. The copper piping is attached to the wall by iron clamps, interposing a fold of India rubber between; a ribbon of zink at specific distances, on the stem, with caoutchouc interposed, preserves the shaft of the conductor from oxydation on a galvanic principle, a small copper wire connecting the dissimilar metals. Finally, the conducting rod enters the surface of the earth, inclined at a small angle, and terminates in the subsoil.

The protecting influence of a good conductor extends on a circle whose radius, or semi-diameter, is double the length of the conducting rod.

I am, Sir, yours respectfully,

J. MURRAY.

Hull, September 11, 1844.

STATISTICS OF STEAM POWER IN FRANCE.

[Translated from the *Moniteur Industriel* for the *Mechanics' Magazine.*]

Neither to philosophical doctrines, nor to constitutional theories, nor to artistical works, is man indebted for the power, the happiness, the liberty, to which he has attained; it is by none of these he has been civilized and ennobled. Such as he is now—such as he is capable of becoming—he has incontestably been made mainly by machinery. Neither philosophical principles, nor political principles, nor moral principles, nor even religious principles, have been able of themselves to make head against slavery. It was by substituting the forces of nature so powerful, for the labour of man so comparatively feeble, that machinery, wherever introduced, first rendered slavery useless. Our corn mills, our saw mills, our spinning mills, our looms, our printing presses, our chemical works,—is it not to them that we are daily indebted for prosperity, wealth, and ease? Suppose we were to be suddenly deprived of all those auxiliaries, should we not find ourselves, with all our ideas, philosophical, artistical, and constitutional, as far behind, as poor and as wretched, as the barbarous nations of old, or as the savage tribes of the present day? Sooner or later machinery will assuredly lead to the complete emancipation of man.

We may be reminded, as a set-off against all this, of the distress of manufacturing towns. But who shall persuade us that, the greater the means of production, the greater the want and misery—that the more there is produced, and the better and cheaper it is, the less there will be to consume? The sufferings of manufacturing towns must not be attributed to machinery, but to the imperfection, to the insufficiency of our social system.

The number of machines in France at the present time is not great, but it is daily on the increase. Within thirty years, should war not put a check to the development of our industry, the number of machines of every sort will be multiplied fourfold. To be convinced of this, it is only necessary to study the statistics of steam power in France, which is admitted on all hands to be the best indicator of the progress of industry in all its branches.

Steam machinery may be divided into three classes. First, steam boilers employed for other than motive purposes, and engine boilers; Second, high and low pressure steam-engines; and Third, steam-boat engines.

I. The following table exhibits the number of boilers in use for other than motive purposes at the beginning of 1833, with the annual additions from that period to the end of 1842.

Before 1833.		1833	1834	1835	1836	1837	1838	1839	1840	1841	1842	Unkn.*	Totl.
Boilers employed for other than motive purposes	460	64	121	140	160	105	98	83	66	76	94	152	1619
Engine ditto	961	165	236	326	363	302	263	352	303	334	428	260	4292

Thus in ten years—in ten years only—the number of steam boilers employed for other than motive purposes, has been tripled, and that of engine boilers nearly quadrupled. The total number of steam boilers of all sorts at the beginning of

* Under this head have been placed those boilers, the date of the erection of which could not be clearly ascertained.

1843 was 5911 (1619 × 4292), of which number 5,270 were of French manufacture; 1619 furnished steam for different arts and manufactures, and the remaining 4292 supplied 3053 steam-engines, 537 of which were low, and 2516 high pressure.

Again, these 5911 steam boilers were divided among 3,633 establishments, of 148 different kinds, which may be arranged into the three following classes:—

748 establishments of 86 different sorts, employing engines only.
2852 .... 51 .... employing both engines and boilers distinct from the engines.
33 .... 11 .... employing boilers for other than motive purposes.

3633

The establishments provided with steam machinery may be ranked according to their importance as follows:—1034 spinning mills; 288 beet root and cane sugar houses; 174 stuff printing works; 149 mines; 142 dye works; 112 engineering establishments; 106 paper mills; 101 stuff preparing works; 96 cloth manufactories; 88 foundries; 87 oil works; 84 baths; 75 saw mills; 66 refineries; 63 weaving works; 50 forges; 45 washing works; 40 blast furnaces, &c.

In 1842 there were 79 departments possessed of steam-engines. Those which had the most were La Seine, 541; Le Nord, 506; Seine Inferieure, 341; Gard, 314; Rhone, 287; Loire, 145; Somme, 96; l'Herault, 88; Haut Rhin, 86; Pas de Calais, 84; l'Aisne, 83; Drome, 83; Loire Inferieure, 60; Marne, 68; Seine and Oise, 55; Les Bouches du Rhone, 47; Ardennes, 47; Oise, 39; Gironde, 37. The following departments possessed but one each:—Aveyron, Correze, Vienne, Cantal, Gers, Côtes du Nord, Dordogne, Lot and Garonne, Hautes Pyrenees.

II. The following table shows the number and horse-power of high and low pressure engines, which have been erected annually from the year 1833 to 1842 inclusive:—

	Before 1833.	1834	1835	1836	1837	1838	1839	1840	1841	1842	Unkn.	Total.
No...	589	115	164	230	252	221	176	258	259	348	204	3053
H. P.	9734½	1425	1941½	2858½	3829	2636¼	2323½	3140½	2854			39009

Thus in ten years has the amount of power been nearly quadrupled, and the number of engines quintupled.

Of these engines 2693 have been constructed in France, and 343 in other countries. It has not been correctly ascertained where the remaining 117 were built. There were 537 engines representing 9,752½ horse-power low pressure, and 2516 of 29,256¾ horse-power collectively, high pressure.

With respect to locomotives, the following is a statement of those which were at work on our railways in 1842:—

Four-wheeled locomotives 51
Six-wheeled ditto 153

Total............ 204

Showing an increase of 76 upon those of the year 1841. By the opening of new lines these figures will, ere long, be increased tenfold.

III. In 1842 our steam navigation was carried on by 229 vessels. The following table shows that this branch of enterprize developes itself but slowly:—

Years.	Vessels.	Engines.	Horse Power.	Merchandize in tons.
1833	75	90	2,600	38,000
1834	82	98	2,800	22,000
1835	100	118	3,800	121,000
1836	105	122	4,000	161,000
1837	124	150	5,400	99,000
1838	160	207	7,500	274,000
1839	225	300	11,300	213,000
1840	211	263	11,400	485,000
1841	227	291	11,800	859,000
1842	229	337	11,700	997,000

The 229 vessels employed in 1842, were appropriated to the following services:—117 to the carrying of passengers and goods; 68 to the conveyance of passengers; 22 to tugging; 8 to tugging and goods; 9 to tugging and passengers; and 5 to tugging passengers and goods.

The 5053 engines erected on land, reckoning them as equal to 3 draught horses, per steam horse power, perform the work of.....	117,027	drt. h.
The 204 locomotives at 45 h.p. each	9,180	,,
The 337 steam-boat engines, at 3 horses per steam horse power	35,000	,,
	161,207	

That is to say, in France steam represents the power of 161,207 draught horses, being equal to the power of 1,128,449 men.

From what has been stated, it will be seen that the increase of steam power is constant, rapid, and considerable. Now, it cannot be disputed that this power is also the index of a constant, rapid, and considerable advancement of trade and business generally. In fact, no one can be ignorant that steam-engines exist for something more than the benefit of their constructors; that they are to all the industrious classes, a means either of increasing the quantity, or improving the quality, or reducing the price of the products of their labour.

If our trade increases in the same ratio, as our steam-engines, within thirty,—nay, even within fifteen years the total results will be immense.

In England, such is the state of property, that so immense a production might only prove a benefit to the few; but in France, where landed property is so divided as it is, such an augmentation of produce could not fail to be the means of a general diffusion of wealth, happiness, and power.

We are glad that our war-loving neighbours are beginning to see where the real secret of our national strength lies, and that it is only by imitating us, in a steady cultivation of the arts of peace, through a long series of years, that they can ever hope to rival us in wealth and power. If we admit, with the writer of the preceding paper, that there cannot in our times be a truer index of the commercial greatness of a people, than the amount of steam power employed by them, we may be excused for adding that it is only by their looking around them, to what others have accomplished in this respect, that they can tell what their actual progress is. The means do not exist of forming an exact contrast between the commercial steam power of Great Britain, and that of France; for in this country there are no returns to refer to, of the number or power of boilers and engines owned by private individuals, except those employed in steam navigation; but we are sure we speak within the mark, when we say, that the whole of France does not muster as much steam power as the single English county of Lancaster alone. Where again shall we find an English county without its scores of engines at work? But in France, it appears, there are nine entire departments which glory in but one each! The truth is, that with us the steam-engine is become everywhere a common tool, while, in a great many parts of France, it has still its way to make—still to make itself known,—and where most in use is but imperfectly understood by the people. The statement before us, affects to distinguish between those engines which are of French manufacture, and those which are of foreign; but to show the whole truth on this head, it should have mentioned also the great number of engines manufactured by English makers settled in France, and the number of engines worked, even at the present day, by English engineers. We fancy it would not be a long or a difficult task, to enumerate the Frenchmen employed as superintendents of English engine manufactories, or of French engineers employed on board of English steamers.—Ed. M. M.

THE CONSOLIDATED MINES OF CORNWALL.

[From Report of Captain G. W. Hughes, of the United States Topographical Engineers, to the Secretary of War, Washington, published in the *Franklin Journal* for July.]

The great mineral district of the West of England, is that composed of the parishes of Gwennap, Redruth, and Cambourne; and, looking to extent of workings, amount and constancy of produce, regularity of system,

and beauty of arrangements, the "Consolidated mines," or "Consols," as they are commonly called, may be regarded as the most important copper mines of that district, and perhaps of the world.*

The Consolidated mines consist of several detached mines which were formerly worked, but not successfully, by independent companies of adventurers. Previous to the year 1818, they had all been abandoned, and became filled with water. In 1819, operations were resumed, by the union of six different mines; and the "Consols," as the union was called, consisted of Cusvea, Wheal Fortune, Wheal Lovelace, East Wheal Virgin, and West Wheal Virgin. In 1824, this association was still further enlarged by the addition of the "United mines," consisting of two mines called Ale and Cakes and Poldory, both of which had been formerly extensively and profitably worked by separate companies.

The Consolidated "selt,"† including the eight mines before mentioned, covers an area of about two square miles, and is surrounded on all sides by extensive and productive mines of either copper, or tin. The direction, or strike, of the main lodes of the Consols, (like those already mentioned,) is nearly due east and west, while the contre-lodes run north-east and south-west. Of the main lodes there are eight, or ten, averaging about 5 feet in width, but occasionally swelling out to 9 feet. The cross, or contre-lodes, are about 18 inches wide.

The ground included within the limits of the Consolidated and united selts, is generally barren in an agricultural point of view, but Mr. Burr says, "some idea, however, may be formed of the mineral wealth of this tract, when it is stated that within the last sixty, or eighty years, it has yielded metallic produce to the amount probably of five or six millions of pounds sterling;‡ to which may be added up to this time, a million and a half more.

These works employ constantly over three thousand persons. In 1830 the entire of the capital which had been invested in these mining operations had been repaid, and, from that time, the produce has gradually increased. The last returns I have seen, gave, as the value of the ores sold, the large sum of 145,717*l.*; the expenses for the same period were 102,000*l.*, leaving a clear profit of 43,717*l.* The Tresavean mine, although yielding a much less amount of ore, is even still more profitable, owing to its being very dry, and requiring comparatively little machinery to raise the water from it. It returns to the adventurers about 50,000*l.* per annum clear profit.

The average quantity of fine copper produced annually by the Consols, is about 1800 tons, or nearly one-tenth of all the copper furnished by Great Britain. The quantity of prepared ores, yielding rather more than nine per cent., is about 17,000 tons; to obtain which nearly 80,000 tons of trash are raised to the surface. A small quantity of tin ore is also raised.

The Redruth railroad passes through the whole extent of these mines, and affords a cheap and convenient means for the transportation of ores to Restrongent creek, a tidal navigable stream, about four miles from the mines, from whence they are shipped to Swansea, in Wales; from the main line, branches are carried to the principal dressing floors and mine buildings, so that the ores from the mines, and the coal from Swansea, require no rehandling after they have been placed in the cars.

The "Great adit," already noticed in another part of this report, passes a short distance to the north of these mines, and serves as a general recipient for the waters pumped from the different lodes, and discharged through the branch adits.

According to Mr. Burr, these mines are about 1800 feet deep; the extent of horizontal under-ground work is not less than 63 miles, while the aggregate depth of pit work, in 1835, was over 25 miles; these distances have probably been extended (to the present time) to at least 30 miles of vertical pit work. The same authority states that the cost of working for discovery and exploration alone, for the twenty years preceding the year 1835, was, in round numbers, 300,000*l.* At that time the machinery employed consisted of eight large steam-engines, used for pumping, varying from 65 to 90-inch cylinders, and one of 30-inches, besides eight steam-engines of 20-inch cylinders, used for drawing ore and trash out of the mines. There was also a water wheel of 48 feet diameter, for pumping, one of 40 feet for driving machinery, and five smaller wheels (all of them being overshot) for stamping and grinding ore, besides several *horse whims*, chiefly employed at the United mines. That gentleman estimated the engine power expended to be equivalent to 5000 horses; and adds, that if it were exerted to its full extent, it would probably be equal to double that number.

* For a more detailed and satisfactory account of these mines, see "Descriptive notice of the Consolidated and United Mines," *Mining Review and Journal*, July, 1835; and Burr's "Elements of Practical Geology."

† The ground included within the boundaries of a mine is called, provincially, a selt.

‡ 1835. The United Mines have, within a few years, been detached, and are, at present, worked by a separate company.

When I visited the Consols, in 1841, the machinery had been increased by the erection of two large steam-engines, and the enlargement of an old engine from a 70 to an 85-inch cylinder, and of another from an 85 to a 90-inch cylinder. Two other engines of 85 and 90 inches respectively were ready for use.

The enormous amount of machinery, and consequent expenditure of money, connected with the working of the Consolidated and United mines, is owing, in a great measure, to their close proximity to the sea, and to the immense depth of the shafts below its surface (about 1500 feet), which, of course, causes a great influx of water from that source.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

William Wright, of Duke-street, Saint James's, Westminster, Surgeon Aurist, *for certain improvements in rendering leather skins or hides impervious to wet, more flexible and more durable.* Patent dated January 11, 1844; Specification enrolled July 11, 1844.

The leather skins or hides are to be heated with one or other of four compositions prepared as follows :—

No. 1; 25 gallons of linseed oil, rape oil, or neat's foot oil are boiled to 20 gallons; 40 lbs. of pure animal fat, and 40 lbs. of fresh bees-wax are added; the mixture is then boiled until a thorough decomposition takes place; 2½ lbs. of gum caoutchouc dissolved in 15 parts of rectified oil of turpentine, and 12½ pints of Burgundy pitch dissolved in 20 pints of rectified oil of turpentine are next added; and the whole finally stirred till cold.

No. 2; oil fat and bees' wax in preportion as before, are raised to a temperature of 150° Fahrenheit, and then 15 lbs. of yellow rosin dissolved in 10 quarts of oil of turpentine are added.

No. 3; 20 gallons of purified cod oil, or highly purified spermaceti whale oil; and 15 to 20 lbs. of gum caoutchouc subjected to from 200° to 250° Fahrenheit, completely amalgamated.

No. 4; 15 to 20 lbs. of gum caoutchouc submerged in rectified oil of turpentine are heated in a sand bath till the fusion is completely dissolved; 20 gallons of purified cod oil, or highly purified spermaceti whale oil, are then added, and when the temperature is reduced to about 150° Fahrenheit, 10 lbs. of fresh bees'-wax are thrown in, and the whole stirred up till cold.

The modes in which these compositions are applied are thus described :

"*Firstly, as to the process for leather hides.* I effect their saturation with the composition No. 1, or No. 2, by placing them in layers, or upright side by side in a tank or suitable vessel, which vessel communicates with a boiler or melter in which the composition No. 1, or No. 2, is prepared; the composition being heated to a temperature of from 100° to 120° of heat of Fahrenheit is then let in upon them, or suffered to flow in upon and amongst them until they are wholly submerged; and in this submerged state they remain from two to three hours, when they will be found fully saturated with the composition. They are afterwards taken out and exposed to a current of the atmospheric air at a medium temperature, until thoroughly dried. I apply hydraulic pressure in this process in vessels and apparatus properly suited to such hydraulic pressure in the ordinary way, or by placing the leather hides in an air-tight vessel, which is then exhausted or partially exhausted of its contained atmospheric air, and in that state of vacuum or partial vacuum, and in this state of the leather hide, I admit the composition which it may be determined to apply to such leather hide upon the principle above stated, such composition being previously heated to a temperature of 100° to 120° of heat of Fahrenheit; the composition in this state being, by the pressure of the external atmosphere, driven into the vessel containing the leather hide or hides and saturating them completely, whenever the intractability or peculiar nature of the hides to be operated upon is found to require more pressure or more effective treatment than is afforded by simple submersion. I use the composition No. 1, when the leather hide has been tanned with oak bark, and No. 2, when it has been otherwise imperfectly tanned.

"*Secondly, as to leather skins.* I effect my improvements by making a complete saturation of the entire substance of the leather skin with the compositions No. 3, and No. 4, hereinbefore described, and I use the composition No. 3, when the leather is very thin, and the composition No. 4, when it is rather thick, and this I perform in practice by placing the leather skins upon metallic plates, heated to 100° of heat of Fahrenheit, more or less saturating them, according to the purposes to which such leather skins are to be applied, with one of the compositions, No. 3, and No. 4, heated to the same degree of heat, viz., 100° of Fahrenheit, for which purpose I use large stiff brushes dipped in the composition, and rubbed over such leather skins. I also perform the process of saturation as described by rarefaction of the atmospheric air, contained in a room constructed for the purpose,

in which manufactured articles formed of leather hides or leather skins may also be subjected to this action of heated or rarified atmospheric air, and although this process does not afford the same degree of saturation as can be obtained under the before-mentioned processes for the saturation of unmanufactured articles, they will yet acquire thereby an improved degree of flexibility, become impervious to moisture, and possess a character of greater durability than when in their unprepared state. I conduct and perform the process with or on manufactured goods, as above-mentioned, by exposing such goods in a *temporated* apartment, at a temperature of from 100° to 120° of heat of Fahrenheit, and the articles thus exposed during from one to two hours; and having so become thoroughly warmed, they are then to be passed over with one of the compositions hereinbefore described until they are saturated therewith; they are then returned to the *temporated* room and subjected to the same temperature until they are dried, which will in general be effected in the space of from half an hour to an hour.

John Aitken, of Surrey-square, *for improvements in atmospheric railways.* Patent dated, Feb. 24, 1844; Specification enrolled, August 24, 1844.

The improvements contemplated by this patentee relate first to the manner or method of producing the vacuum in the pipe; secondly, to the manner of sealing the longitudinal valve. The specification sets forth the disadvantage under which the exhaustion of air from the pipes is carried on after a few strokes at the commencement; each succeeding stroke of the pump withdrawing a less and less quantity of air. To prevent this waste of power, the patentee proposes to fill the pipes with water, and to have exhaust pipes placed at intervals of about one mile apart. These exhaust pipes are to be bent downward, and where convenient to be carried to a considerable depth, by which means the water will be more speedily withdrawn from the pipe, and leave a vacuum therein to act in propelling the train. The end of the exhaust pipe must be bent upward, or immersed in water to prevent the admission of air at that part. When the railway happens to be upon an incline, there must be an eduction valve placed at every such distance apart as shall subject the longitudinal valve placed on the top of the pipe to a one-foot head pressure, and the longitudinal valve must be loaded accordingly to prevent the escape in that direction of the water from within. Where it is not convenient to have the exhaust led off by a descending pipe, the patentee proposes to apply a pump for that purpose.

With respect to the manner of sealing the valve, it is proposed to effect this by laying the pipe in a trough between the lines of rail, so that a few inches of water may at all times be kept upon the longitudinal valve. When the rails are upon an incline, the patentee proposes to have a constant stream of water running along on the top of the valve.

The claim of Mr. Aitken is to the method described of exhausting the pipes, and of sealing the valve.

Richard Ritson, of Cleckheaton, Card Manufacturer, and John Garthwaite, of Leeds, Flax Spinner, *for improvements in rove cards for carding cotton, wool, silk, flax, and other fibrous substances, and for producing tow and yarns from line and tow yarn waste which comes from the spinning frames, commonly called hard waste.* Patent dated Feb. 27, 1844; Specification enrolled, August 27, 1844.

1. *The improvements in rove cards.*—The patentees commence by referring to the difficulties which rove card manufacturers have heretofore had to contend with in providing suitable leather for the purpose. The best and most expensive parts of the hides are required, and even these parts present difficulties in their application from their unequal thickness. To obviate these objections the patentees propose to employ sheepskin, roan, and basil, in combination with a covering of linen, or some other woven fabric, cemented to the flesh side of the skin. The cement recommended for attaching them together is a compound of glue and Irish moss dissolved in water. On some occasions they find it necessary to use two skins with a piece of linen connected between, or when greater strength is required, they combine a greater number of plies of skin and linen, or other woven fabric.

2. *The improvements in the manufacture of tow yarn waste.*—These consist in subjecting the waste to the action of the well-known machine called the "devil;" then boiling it with soft soap; next passing it through pressing rollers, and drying; then passing it through the breaker or carding engine; and finally through the finishing engine; after which it is ready for being spun.

Claims.—First, the cementing together of sheep skin, roan, or basil, with woven fabrics, to be used in the formation of rove cards. Second, the manufacture of tow yarn from line tow yarn waste in the manner described.

John Stevelly, of Belfast, Professor of Natural Philosophy, *for improvements in steam-engines.* Patent dated,

March 2, 1844; Specification enrolled, September 2, 1844.

The first of Professor Stevelly's supposed improvements has for its object a more economical method of condensing steam, both as regards the quantity of water used for that purpose, and the application of the heat derived from the same. The Professor proposes that the stream of cold water admitted through the rose into the condenser should be allowed to issue only at that time when the steam is escaping from the working cylinder, and not throughout the whole length of the stroke; and that this should be accomplished by the employment either of eccentrics or rocking shafts to move the inlet valves. He proposes further, that instead of one condensing vessel two or more should be employed. The water which is in and around the first of the series of condensing vessels being the hottest, (as the steam at the moment it enters therein will give out the greatest portion of its heat,) this is to be more especially devoted to the purpose of feeding the steam boiler.

The second head of the specification introduces us to what Professor Stevelly calls a "conjugate cylinder." This consists of one cylinder placed alongside another; both piston-rods being connected to the same shaft, but each by a separate crank placed at right angles to the other crank, by which means the most effective portion of the stroke of the one cylinder is performed during the interval of the least effective portion of the stroke of the other.

We come next to a self-acting feed apparatus for the steam boiler—a priming preventer, composed of a wire-gauze, or perforated plate, surrounding the mouth of the steam pipe, and placed within the dome of the boiler (as exact a copy as can be of Allen's registered preventer, now in very common use)—and a condenser formed of numerous plates of metal placed at short intervals apart, through and between which the atmospheric air to supply the furnace is allowed to pass, so that the steam is thereby condensed, and the air heated previous to coming in contact with the fire.

Finally, there is a feed apparatus described, which consists of a separate boiler, or hot water reservoir, the communication between which and the boiler is opened up by means of the action of a float placed within the steam boiler on a cock placed in the hot water reservoir.

PETER WARD, OF WEST BROMWICH, STAFFORD, PRACTICAL CHEMIST, *for an improvement in combining matters for washing and cleansing.* Patent dated, March 4, 1844; Specification enrolled, September 4, 1844.

The improvement set forth in this specification relates more especially to the method of mixing alkaline substances with glue, gelatine, or mucilage to form a compound fitted for use in washing, scouring, and cleansing, and susceptible of being used with greater advantage in cases where soda and potashes are generally employed. The mode in which this compound is prepared is as follows:—the alkali, whether soda or potash (but in the generality of cases the patentee prefers soda), is ground by the action of an edge rolling mill, and while this process is being performed, a solution of glue or gelatine is added to the alkali, and ground up along therewith, until they are thoroughly amalgamated, when the mixture is passed through sieves, and spread out upon a floor to dry for a few hours, after which it is to be turned over, and again allowed to dry for twenty-four hours. The process of turning over is then once more repeated, and the substance allowed to remain until it is sufficiently fit for use; the time being longer or shorter according to the state of the weather. The quantity of water used by the patentee for dissolving the glue is in the proportion of 45 gallons of water to 1 cwt. of glue. When the patentee uses mucilage instead of glue, he prefers linseed, or oilcake; and for this purpose it is mixed with a quantity of water, to dissolve the mucilage; the water is then strained off, and used in the same manner as before described in reference to the solution of glue.

The patentee does not claim the application of a compound of glue and alkali, or mucilage and alkali, as applied to the purposes of washing and cleansing; but he claims the mode above described of mixing those substances.

GEOMETRY OF THE ARCS OF CIRCLES.

Sir,—Mr. Sankey in his communication on the Arcs of Circles, at p. 122, states—

"Suppose A C D a sector of a circle; A T tangent of arc A D? C T secant, and let G C be so taken on radius A C, that raising the perpendicular G F — the triangle G C F shall be equal to the given sector A C D."

The difficulty would appear to be this—how is G C to be so taken on radius by the aid of Geometry alone? By calculation, and tables, the length of the line may be found, but I do not see any mode of obtaining it by Geometry. Yours, &c.

C. C. C. C.

September 7, 1844.

DRAINAGE OF HARLEM LAKE.

Mr. Arthur Dean, C. E., presents his compliments to the Editor of the *Mechanics' Magazine*, and begs to inform him that he is correctly described in the text of an article "on the Drainage of the Lake of Harlem" (published in the *Mechanics' Magazine* of August 31,) as joint engineer with Mr. Joseph Gibbs, for pumping out the Lake of Harlem; and Mr. Dean is not aware of Mr. Alexander Don being, or having been in any way engaged on the work, as suggested by an editorial note appended to the beforementioned article.

6, New Broad-street, September 5, 1844.

NOTES AND NOTICES.

Invention of Gunpowder.—The credit of its European discovery, so generally attributed to Schwarz, may with great reason be disputed, since we find in a MS. belonging to Hudson Gurney, Esq., a receipt to make gunpowder written by an English scribe about 1300, in very precise terms, viz., saltpetre, quick sulphur, and charcoal from willows; it is termed a powder "ad faciendum *le Crake.*" Guns are called *crakeys* of war in Gavin Douglas's Translation of the Eneid, fol. Edin., 1820.—*United Service Magazine.*

Invisible Writing.—The plan of writing with rice water, to be rendered visible by the application of iodine, was practised with great success in the correspondence with Jellalabad. The first letter of this kind received from thence was concealed in a quill. On opening it a small paper was unfolded, on which appeared only a single word, "iodine." The magic liquid was applied, and an interesting despatch from Sir Robt. Sale stood forth.—*Major Smith, United Service Magazine.*

Vegetable Essences.—The application of chemistry to cookery in France has produced a curious result, and one likely to be as useful as curious. M. Milot, of the Academy of Sciences, has succeeded in obtaining by distillation, in a pure, colourless and liquid form, all the properties of various culinary vegetables. Thus he can put you up a bottle of carrots, parsnips, turnips, or onions, and you may carry it all over the world, certain of having with you the true flavour of the vegetable. A table spoonful is enough for one pound of meat. The secret lies in the mode of distillation, by which the offensive parts of the vegetable are left. It is already an object with commercial men to export these essences, which are termed aromatique, to the French colonies, and with the government there is an intention of using them extensively in the Navy.—*Newark Advertiser.*

New Railway Wagons.—A new description of goods' wagon or box has been in use on the Manchester, Leeds, and Hull Associated Railway during the last few weeks. In appearance they are very much like a cottage placed upon a truck, are about 12 feet long and 6 to 8 feet high, have, instead of the loose covers used on other wagons, substantial sloping roofs, are completely boarded up to the roof, have a door in the middle of each side, and a trap-door in the floor. They are at present chiefly used for salt, of which each wagon is capable of containing six tons, but they are loaded up to four and a half tons.

French Air-propelled Locomotive.—The first trial of M. Andrau's new locomotive power, by means of compressed air, has been made on the Versailles Railroad (left bank), in presence of Messrs. Bineau and Baude, commissioners appointed by the Government, of the engineers of the railroad, and a great number of spectators. Although the locomotive was charged upon the low pressure system, because there was not a sufficient power to compress the air to a greater extent, the experiment perfectly succeeded. In expanding two or three atmospheres, the locomotive ran a quarter of a league with great rapidity and regularity; the trial is to be repeated in the course of next month.—*Paris Papers.* For a notice of a similar engine by Cotter, see our last vol., p. 432.

Marsh's Concussion Shells.—On Monday last, Lieutenant-Colonel Dansey, C.B., Lieutenant-Colonel Chalmers, and Lieutenant-Colonel Sweeting, with a detachment of the Royal Artillery under Lieutenant-Colonel Colquhoun, assembled in the marshes to witness and carry on experiments with concussion shells, the invention of Mr. James Marsh. The experiments were made from one 68-pounder gun and two 32-pounder guns, at 800 yards' distance from the bulk-head, the object aimed at being double the usual point blank range. The fuzes were made in the same manner as the common fuzes of the service, and calculated to burn seven seconds and a half, and then burst with certainty, or at an earlier period, after striking the side of a ship or other hard obstacle. This is effected by having four small copper caps, similar to the thimbles used by children, inserted at four different places, like the points of the compass, and attached with Jeffery's marine glue. The firing of the shell is attended with sufficient heat to melt that substance, but none of the caps, which are filled with the meal powder, fall out until the shell strikes with great force against the object aimed, when the lower cap falls out, and the shell bursts with great force immediately after, causing great havoc amongst the timbers of the bulk-head, as was shown on Monday, proving that its effects would be terrible on board of a vessel containing human beings, and affording evidence how soon the most powerful guns might be made unserviceable. On Wednesday, some further experiments were made. There were fifteen shells fired on this occasion, five of them 68-pounders and ten 32-pounders. Two of the 32-pounders burst on entering the bulk-head, six in the mound immediately after passing through the bulk-head, one exploded at from forty to fifty feet high, having taken an upward direction after striking the base of the mound, and one did not burst, having entered the earth of the mound to a considerable depth. The first 68-pounder shell went through the bulk-head, and burst immediately after in the mound; the second burst in the bulk-head; the third burst in the bulk-head; the fourth did not burst, having entered the mound without touching the bulk-head; and the fifth burst with tremendous effect in the bulk-head, tearing to pieces the iron bolts, three-quarters of an inch square, which held the timbers together, and throwing forward 2 feet 6 inches at one end of the bulk-head, and 6 inches at the other end, seven strong pieces of oak made to represent the side of a ship, and each piece 12 inches square and 30 feet long. The destruction was awful, and greater than any we have ever witnessed, showing that it would be impossible for ships of the first rate to resist the destructive power of these missiles. The experiments were made to ascertain if Mr. Marsh's invention of attaching caps with marine glue would carry a long range of 800 yards, and proved that they could be made available for any distance with certainty of effect, and no danger to those using them.—*Times.*

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CLEMENT'S CHIMNEY GUARD AND VENTILATOR.

Fig. 1.

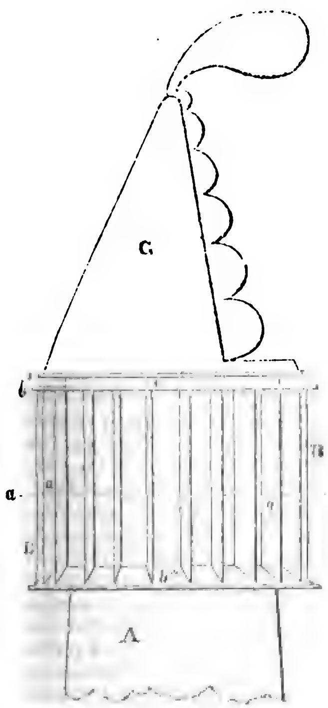


Fig. 2.

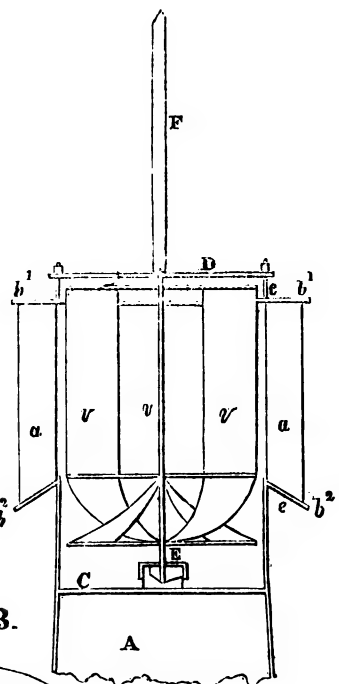
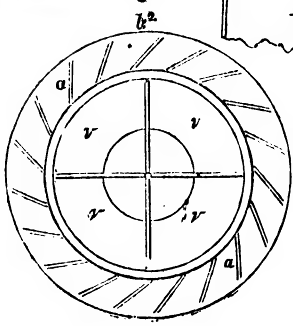


Fig. 3.



CLEMENT'S CHIMNEY GUARD AND VENTILATOR.

[Registered under the Act for the Protection of Articles of Utility. Henry Clement, of Bath, Ironmonger, Proprietor.]

Chimney guards there are, which guard so well the passages on which they are mounted, that they both keep the wind off and the smoke in; and ventilators, again, so ambidextrously contrived that they produce as often a downward as an upward current. The inventor of the present apparatus has very successfully combined both objects—perfect protection from external assaults of wind, and perfect draught in the right direction. Blow from what quarter it may, the wind cannot blow down a chimney provided with such an apparatus as this; and whether it blow rudely or gently, it can but help more or less to assist the up-draught of the chimney. The mouth of the shaft is so guarded, that any current of air crossing it, can strike against the vanes of the ventilator in one direction only, and that the direction by which an ascending current is produced; and as the atmosphere is rarely so still at the height of chimney tops—more especially when there is an emerging column of heated air acting upon it—as to be free from such cross currents, the ventilator must be nearly always in a state of active rotation. Of no other ventilator, that we are acquainted with, can as much be said; and yet it is obvious that a ventilator at rest must be something worse than useless—a positive obstruction. The means by which this constant and uniform rotation is produced, in the present apparatus, are very ingenious, and we believe quite new.

Fig. 1 is an external elevation of the apparatus; fig. 2 a sectional elevation; and fig. 3 a plan on the line *a b*.

A is a hollow conical shaft, by which the apparatus is fitted on to the top of the chimney. B, a circular cupola mounted on the top of the shaft A, consisting of a series of fixed leaves, *a a a*, all inclined in one direction inwards (see fig. 3), and connected at top and bottom by two rings, b^1 b^2. The bottom ring, b^2, is deflected downwards at *e e*, in the manner particularly shown in fig. 1; the top ring, b^1, is made flat, and terminates on the inside in a raised ring *c*. C is a cross bar fixed in the shaft A, and D a similar cross bar fixed to the top of the ring b^1. E is a vertical spindle, which turns freely in bearings in the cross bars C and D, and carries four vanes, *v v v v*, at right angles to one another; these vanes being cut away lengthwise near to the spindle, and curved inwards at their extremities, both as shown in the figures.

F is another spindle, which rises from the top of the cross bar D, and carries the weather cowl G.

It will at once be seen that from whatever side the wind may blow, the cowl G will serve to protect the mouth of the chimney from the main body of the current, while the least current of air entering between any of the leaves, *a a a*, is certain to impinge against and turn round the vanes of the spindle E, and thereby to produce an upward current within the chimney, or to accelerate that arising from the ascension of the smoke and heated vapours.

WARMING AND VENTILATING BUILDINGS.

Sir,—In consequence of an article that appeared in the *Times* of the 23rd August last, I was induced to purchase a copy of the second edition of Mr. Hood's Treatise on Warming and Ventilating Buildings, and have read it with much interest and gratification, in consequence of the very valuable information it contains; but it appearing to me that one important point connected with ventilation has been overlooked by those who have hitherto given their attention to this truly important subject, I am induced, with reference to my letter of the 12th ult., to trouble you with a few additional remarks for insertion in your journal; for, if I am right, the data on which the present theories and calculations of the motions of the products of respiration and perspiration are based, must be erroneous.

In article 291, page 251, Mr. Hood states, "Although the carbonic acid gas given off from the lungs is rather more than 37 per cent. heavier than the oxygen which is consumed, still in consequence of the dilatation of its volume by the increased heat, and the greater levity of the vapour given off from the lungs, the air is specifically lighter at the

moment of its expiration than at its inspiration. For 800 cubic inches of pure air at the temperature of 60°, and the dew point 40° will weigh 243,395 grains; but 800 cubic inches of air at 95°, containing eight and a half per cent. of carbonic acid gas, and 5·6 grains of vapour, with the dew point 85°, will only weigh 232,450 grains; being nearly five per cent. lighter. Hence air, when expired from the lungs, always rises upwards, and will flow through ventilators in the ceiling or the upper part of the walls of a room, if such be provided for its escape; but otherwise the vapour condenses, and the volume of the air collapses as it cools; it then becomes heavier than the substrata of air, and *sinks* to the lower part of the room contaminated with impurities."

It is evident from the above that Mr. Hood, like those who have preceded him, assumes that carbonic acid gas in combination with vapour, is subservient to a general law of diffusion; but atmospheric air is capable of holding vapour in solution or suspension in proportion to its *rise* in temperature, and carbonic acid gas combines with vapour; and furthermore, vapour, when in motion, is a good conductor of heat; the vapour, therefore, on leaving the lungs at the temperature of 95°, will, on coming into contact with the external air, or that of a room at 60°, part with its superabundant heat; and if the loss of caloric be not sufficiently rapid to cause its immediate condensation, its temperature will certainly be sufficiently reduced to produce that effect, long before the vapour and carbonic acid shall have reached the external air through the upward ventilators proposed. In article 171, Mr. Hood clearly defines the principles on which a deposition takes place on the windows and other parts of ill-ventilated rooms; the glass is but the conducting medium between the two atmospheres, both charged with vapour in proportion to their amount of temperature, and if the window be opened a little either at the top or bottom, a rush of air will immediately enter the room, to fill up the vacuum caused in a great measure by the more rapid condensation of the vapour of its atmosphere, and the inward current of air will continue, so long as there is any difference in the temperatures of the two atmospheres.

The combination of vapour with the carbonic acid, as it escapes from the lungs, appears to me to be a provision of Nature, by which she ensures the purity of the atmosphere for the animal kingdom. During very hot weather, when the difference of temperature between the external air, and that expired from the lungs is but small, animals naturally seek the coolest place, where the products of respiration and of perspiration are blown away as fast as generated; and if man be confined to a house, he finds it indispensably necessary, notwithstanding all that may be said against such a practice, to keep both windows and doors open to ensure a current of air through the building; but during winter, or in those climes where the thermometer is frequently much below 0, man naturally shuts himself up within as small a space as possible, in order to prevent the too rapid escape of heat from his body, and the amount of moisture given off from the lungs increases with the increase of carbonic acid generated by respiration, and therefore ensures its condensation.

What a beautiful illustration have we not then in the process of respiration of the simple, but truly efficacious manner in which the Creator accomplishes his purpose! Air expands with heat, and therefore in the tropics, where the air is highly rarefied (Note to Art. 291), little oxygen is taken into the lungs at each inspiration, and an abundance of food, calculated to cause perspiration, and to keep the system cool, is provided for the sustenance of man; whilst in those regions where the atmosphere is intensely cold and dense, man lives entirely on animal diet, such as train oil and blubber, which, from the great quantity of carbon it contains, is admirably calculated to support the functions of respiration, and consequently by combining with the increased quantity of oxygen taken into the lungs at each inspiration, to cause the generation of an increased quantity of heat to counteract the external cold, but does not cause perspiration.

To the condensation of carbonic acid by change of temperature is also to be attributed, I conceive, the faulty results that have been arrived at in analysing the atmosphere of crowded rooms, it being evident that the air, in its passage over the mercury on entering the bottle,

would be reduced to the temperature of the mercury, or nearly so; and, as air holds vapour in suspension in proportion to its rise of temperature, supposing the mercury to be of the temperature of the external air, the air in the bottle could contain but little more carbonic acid than the external atmosphere.

If it has not been decided then by actual experiment whether the products of respiration are subservient to a law of diffusion, or to those of gravitation, I venture to suggest for the consideration of those who have the means and leisure to undertake the laborious task, whether, as a first step, it be not indispensably necessary to determine what really is the constitution of the atmosphere of a room at different heights when occupied by human beings, both by night and by day. It appears to me that this may best be effected by drawing off the air of the room through three Woolf bottles containing cream of lime, or a solution of a caustic alkali, or possibly both, and placing one within a few inches of the ceiling, one in the centre of the room, and the third within a few inches of the floor. The air may be drawn off by mechanical means, or by connecting the exhausting tubes with the ash-pit of a stove placed outside the room experimented upon, which perhaps would be attended with less trouble. The vessels being weighed before and after the experiments—which I conceive should be made on various rooms at different periods of the year, both by day and night—the total amount of increase will be ascertained; and deducting for the increase in the weights of the carbonic acid, *which may be collected over water oxidulated with sulphuric acid, as it does not absorb it,* the respective amounts of vapour and carbonic acid will be determined.

That the electric condition of the air has a great influence on the system (art. 294) there cannot be a question; but I suspect that the generation of carbonic acid, whether by respiration, or the decomposition of organic matter, induces negative electricity, and if so it will be evident that electric condition and state of an atmosphere are one and the same thing, when speaking of ventilation; and in the same light we must regard the words, temperature and moisture, when speaking of the atmosphere of an apartment crowded by human beings, the one being dependant upon the other; and I venture to suggest whether the evaporation of water in an apartment, the atmosphere of which is surcharged with carbonic acid, be not productive of benefit, as much, (if not more,) by carrying off by condensation a certain portion of carbonic acid, as by the generation of positive electricity.

With reference to the observation made by Mr. Hood (art. 1299), that many of the methods of producing artificial heat are materially affected, as regards their wholesomeness, by the fact of their being able or not to decompose or chemically alter certain floating particles of matter suspended in the air, it may be remarked that all the stoves that have hitherto been produced, such as the Nettleton, Nott, Arnott, Joyce, and other close stoves, as well as the hot water apparatus, are constructed on the principle of obtaining the greatest amount of heat with the least possible expenditure of fuel, and that if the present theory of ventilation be incorrect, these stoves and pipes must at all times be surrounded by carbonic acid and vapour, which by decomposition evolve carbonic oxide and hydrogen; and that, even supposing no such decomposition to take place, the want of ventilation is quite sufficient to account for all the evils induced. In all cases where a supply of warm air has been brought into a room, by causing the external air to pass over the heated surfaces of *open fire-places*, it has been invariably introduced at such a height that in its ascent it must necessarily become impregnated with the products of respiration, which, when condensed, are breathed over again; whereas, if a *sufficient supply* of fresh air at a proper temperature be introduced at the top of the room, and drawn off at the bottom, the increased specific gravity of the carbonic acid and vapour, together with the downward current produced by the open fireplace, as suggested in my letter of the 12th ult., will assuredly prevent the possibility of any of these noxious compounds ever re-entering the lungs—the temperature of the air being regulated by the adjustment of the stove in accordance with the principles of combustion.

I beg lastly to express my humble opinion, how greatly indebted the world at large is to Mr. Hood for the manner in which he has brought under notice,

in so condensed a form, the necessity of attention being paid to this truly important subject. A perusal of his work is highly calculated to excite the commiseration of philanthropists on behalf of their fellow-creatures who have to spend the best part of their days in ill-ventilated rooms, where for several months in the year they are subject to the very pernicious influence of cold drafts, and of an atmosphere that slowly but constantly undermines their constitutions (art. 292).

I remain, Sir,

Your obedient servant,

FRANKLIN COXWORTHY.

London, September 12, 1844.

THE QUARTERLY REVIEW ON THE INTRODUCTION OF STEAM NAVIGATION.—MR. SYMINGTON'S CLAIMS REASSERTED.

Sir,—After all that has been written, said, and published in favour of Mr. Symington being the inventor of practicable and useful steam navigation, and after the clear and luminous manner in which you have, on various occasions, brought forward his claims, I must confess I was not a little surprised on perceiving such conjectures, opinions, and assertions as are expressed in an article on "Railway Legislation" in the last number of the *Quarterly Review.*

The Reviewer tell us,—

Firstly—That "when Captain Savery obtained a patent for his steam engine applicable, as *all* the earlier projects for the employment of steam were, to the mere raising of water, he indicated vaguely indeed, and humbly, that it might also be applied to maritime purposes."

If "*all* the earlier projects for the employment of steam were applicable to the mere *raising of water,*" there cannot be a doubt, that Captain Savery must have had in view the application of the steam engine to a marine pump. A truly maritime purpose.

Secondly—That Jonathan Hulls was "proved" by the Reviewer in the 19th vol. of the *Quarterly*, page 355, to have been "the inventor of an *actual* steam boat in 1738, which, however, fell into early *disuse and oblivion.*"

If it fell into early *disuse* and *oblivion,* it is not easy to see how it could advance steam navigation.

Thirdly—That "Mr. Watt, in some of his specifications of his inventions, suggested their applicability to carriages, but never, he believes, attempted to construct one."

It was not very likely that Mr. Watt would make such an attempt, seeing, that if he thought steam navigation impracticable (as it is known he once did), he could scarcely entertain a more favourable opinion of terra-locomotion.

Fourthly—That "about 1787, Mr. Millar, of Dalswinton, published a project for a *steam boat,* which was a few years afterwards executed by *one* Symington, a *workman* of Mr. Millar's, successfully as to locomotion; but being too large for *the canal* on which it was built, it was broken up."

Where the Reviewer acquired his information, I know not; but this I do know, that it is extremely incorrect, and ought to have been more strictly tested before being admitted into a journal of such weight and authority as the *Quarterly Review.* The first steam boat was not tried on a canal at all, but on Dalswinton Lake, in 1788—being the year following the publication of Mr. Millar's pamphlet, instead of a few years afterwards. The project of applying steam power for the propulsion of vessels was not Mr. Millar's, but Mr. Symington's, who suggested it while Mr. Millar was inspecting a steam carriage, afterwards to be adverted to. The boat was neither built nor broken up on the canal, and never made its appearance there at all as a steam vessel. A boat—another one altogether—was tried on the Forth and Clyde canal, in 1789, and was only given up because Mr. Millar had embarked with all his energy in agricultural improvements. So much for the accuracy of the Reviewer's assertions concerning the boat. He is equally incorrect in saying that Mr. Symington was a "*workman*" of Mr. Millar's. He was no such thing—Mr. Millar never having paid him for his services, nor ever having been asked to do so. In point of fact, he expended much more than Mr. Millar ever did on these experiments. Indeed, Mr. Symington has publicly recorded, that had Mr. Millar offered him money he would not have accepted it, as he was then lucratively employed by a wealthy mining company, one of the managers of which, Mr. Gilbert Meason, lent him his aid most liberally towards carrying

out Mr. Symington's inventions. A great deal has been said of the large sums laid out by Mr. Millar in his steam boat experiments, but his outlay on that score was trifling, considering especially the mighty purpose which was sought to be accomplished. Were its various items to be given to the public, unconnected with the numerous visionary schemes in which Mr. Millar embarked, it would be an absurdity ever again to talk of its magnitude.

Fifthly—That "Mr. Symington also exhibited about the same time a steam carriage." It was while exhibiting the steam carriage to Mr. Millar in 1786, that Mr. Symington suggested the use of the steam engine in navigation. Mr. Millar at first pronounced this to be impracticable, as "it would set the vessel on fire." Mr. Symington succeeded in removing this objection, and showed Mr. Millar how the paddle-wheels could be connected with the engine, by referring to the steam carriage then before them.

Sixthly—That "it is obvious the success of either boat or carriage, which ever should first happen, would inevitably produce the other; for the paddles of the boat, and the wheels of the carriage, are the same thing in principle, and the application is almost identical."

According to this admission, Mr. Symington's claim cannot be objected to even by the Reviewer; the carriage not only having, by several years, *preceded* both the pamphlet and the boat, but having served to illustrate the practicability of steam navigation.

Knowing, as I do, the distress and suffering Mr. Symington brought upon himself and family, through his unwearied efforts to give to the world his inestimable invention, I deem it but an act of justice due to his memory to resist any attempt to deprive him of the merit to which he is entitled.

Hoping that you will afford this a space in your valuable periodical,

I remain, Sir, yours, &c.

ROBERT BOWIE.

13, Billiter-square, Sept. 10, 1844.

P.S. Since writing the preceding pages I have examined the *Quarterly Review*, vol. 19, page 355, closely, and find that there is no *proof* there whatever of Jonathan Hull's having been the inventor of an *actual* steam boat. He gave a *design* for one only.

R. B.

THEORY OF PARALLEL LINES.

Sir,—My last article (No. 1088) headed "Geometrical Exercises," might have been more properly entitled like the present, "Theory of Parallel Lines." The last proposition (3) is incomplete. Since sending you that paper I have made some extensions, and gone a little more into detail on the said proposition, in order to show its connexion with the subject of Parallel Lines.

Fig. 1.

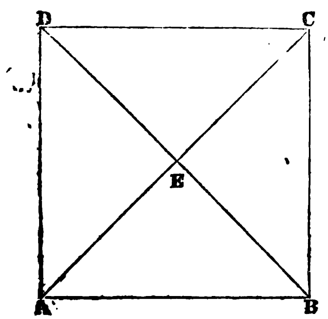
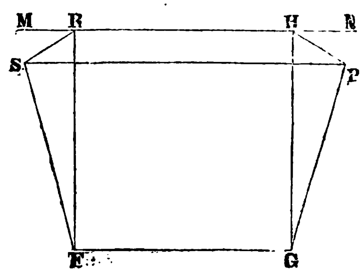


Fig. 2.



Proposition 3.

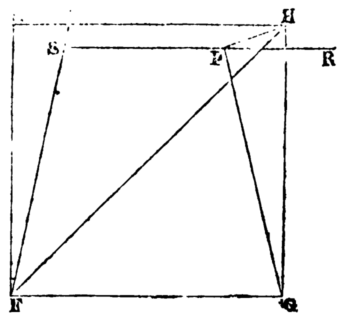
If a quadrilateral be equiangular and its opposite sides equal, it shall also be rectangular. (See Prop. 1st).

Let A B C D be an equiangular quadrilateral, having the sides A B equal to D C and A D to B C; then shall the figure A B C D be rectangular.

Describe the right-angled triangle F G H, having the angle F G H a right angle, and the sides F G, G H equal to the sides A B, B C each to each, and upon F H describe the triangle F K H, having the sides F K, K H equal to the sides H G, F G, or to C B, B A; then the angle F K H will be a right angle, and the angle K F G will be equal to the angle K H G, and the figures A B C D, F G H K will be identical, and each rectangular.

For, if the angle A B C be a right angle, or the angle D A B be equal to K F G, in either case it is manifest that the figures A B C D, F G H K will be identical, and each rectangular. But if the angle K F G is not equal to the angle D A B; suppose the angle K F G is constant, and the angle D A B is variable;* and first, that the angle D A B is acute and less than K F G, make the angle G F O equal to D A B, and let F O meet K H in O, the angle F K O being a right angle, F O is greater than F K; cut off F S equal to A D or F K, and make the angle F S P equal to A D C; then, since the angle F S P is acute, O S P is obtuse, and O S P is also obtuse; hence, S P and O H cannot meet when produced in the directions of O H and S P. Make the angle F G P equal to S F G, or B A D, and let G P meet S P in P. Join P H, and produce S P to R; then, since S R does not meet O H, and P H meets it, the angle G P H is greater than G P R. Then, by joining F P, S G, we prove that the figures S F G P, and A D C B are identical, and consequently, the angles F S P and S P G equal, and each acute. But this is impossible; for G P being equal to G H, the angle G P H is acute. So also is G P R acute; and therefore, the equal angles G P S. F S P will be obtuse, and consequently, S P will be less than F G (Prop. 2, No. 1088), which is absurd. Whence it follows, that the angle G F S, or B A D cannot be acute, and less than G F K; nor can the angle G F S, or D A B, or F G P, be less than the angle F G H; that is, less than a right angle. Suppose the lines G P and F S to revolve round the points G and F in the directions of G H and F K; so long as the angles F G P, S F G, are less than the angles F G H, G F K, so long will these errors exis ; but when the revolving line G P comes to coincide with G H, the angle F G P, or A B C, will be a right angle; but when the angle F G P is a right angle, the angle B A D, that is, the angle G F S will be a right angle (by the 1st part of this Prop.); or the line F S will coincide with F K, that is, G F K will be a right angle; then all the errors of supposition will vanish together, and the figures A B C D, F G H K will be identical, and each rectangular.

Having proved the constant angle K F G to be a right angle, the angle D A B cannot be obtuse. Suppose D A B, A B C



to be obtuse, and consequently greater than K F G or K H G, produce K H to M and N, and as before construct the figure S F G P, equal in every respect to D A B C; then because the lines F S and F K are equal also, G H and G P are equal, and the angles F K M, G H N are equal, each being a right angle; hence these points S and P will both fall below the line M N. Join S K and H P; then, because F S is equal to F K, the angle F S K is acute; and, therefore, the angle S P G is also acute, whence (Prop. 2nd) S P is greater than F G. But S P is equal to F G, for both are equal to A B or D C, and the angles F S P, G P S are each obtuse, each of them being equal to D A B, which is obtuse by hypothesis. Hence the angles F S K, G P H will be obtuse, and F K will be greater than F S, and G H greater than G P; and these results

* That the angle G F K has a constant, although an unknown value, is evident; for F G, G H (Figure 2) being both given lines, and F G H, a right angle, G F H has a fixed value; so, also, has the angle K F H; hence, the whole angle K F G is invariable or constant. But as the two lines A C, D B may bisect one another at any angle; the angles D A B, A B C, &c. (Fig. 1) may be affected by this circumstance for anything we are yet supposed to know to the contrary; that is, they may be supposed to be variable.

are all contrary to hypothesis. Wherefore, the angle D A B or S F G cannot be obtuse, and in the same way as in the first case, if we suppose the lines F S, G P to revolve round the points F and G in the directions F K, G H, the errors will not disappear until F S and G P coincide with F K and G H, then the two figures S F G P, K F G H will be identical, and each rectangular.

Cor. Hence, the two acute angles of any right-angled triangle are together equal to one right angle, from which it follows that the three angles of every plane triangle are equal to two right angles.*

George Scott.
Private Teacher of the Mathematics.
5, Winchester-row, New-road,
Sept. 10, 1844.

COLONEL MACERONE'S (*Alias* WRIGHT'S "PATENT") WATERPROOF COMPOSITION.

Sir,—This truly seems the age to patent *old* inventions, for scarcely a month passes by, without bringing forth some old invention resuscitated and invigorated by the aid of Royal Letters Patent.

Your Number for Saturday last (page 189) contains a specification of a patent recently granted to Mr. W. Wright for certain improvements in rendering leather impervious to wet, more pliant and more durable. Four compositions are set forth for this purpose, one of which (No. 2), and the only one, in my opinion, that is really good for anything, will doubtless have been recognised by your attentive readers, as the waterproof of Col. Macerone, the subject of so many commendatory notices in your numerous past volumes. The proportions of the several ingredients, it is true, are not precisely those recommended by the worthy Colonel, nor are they such as I consider, from ten years' experience, the most eligible. The oil of turpentine (the only new ingredient) is by no means necessary—indeed it is prejudicial rather than otherwise.

The patentee likewise intimates that linseed, rape, or neat's-foot oil may be used indifferently: in this, however, he is greatly mistaken; vegetable oils are highly improper—animal oils alone are adapted for this purpose. I have long used a modification of the composition, No. 2 (minus the turpentine) as a dressing for leather to be manufactured into engine hose with the best results; and as soon as the prejudices of our curriers will allow them to comprehend and appreciate the good qualities of this composition, it will be most extensively employed.

Unfortunately, the old remark applies with great force to the improvement of Mr. Wright, that what is useful is not new, and what is new is not useful. Moreover, I apprehend his patent would be void from the defective wording of his specification. What, I would ask, is meant by boiling 50 gallons of fat and oil (No. 1) "until a thorough decomposition takes place:" *i. e.* until it is destroyed and rendered good for nothing? Or what are we to understand by the direction (No. 4) to submerge 20 lbs. of caoutchouc in rectified oil of turpentine, heated in a sand bath, "till the *fusion* is completely *dissolved?*"

Again, it would be no joke for the poor mortal left in charge with 50 gallons of boiling fat and oil, "to be finally stirred till cold." The "complete amalgamation" of fish oils and caoutchouc, at a temperature of 200° of Farenheit, strikes me as something new, but I dare say it's all *Wright.*

Yours respectfully,
Wm. Baddeley.

29, Alfred-street, Islington,
Sept. 15, 1844.

IMPROVEMENT IN THE SUGAR VACUUM PAN.

(Registered under the Act for Protection of Articles of Utility. Mr. John Russell, of Greenock, Proprietor.)

The present improvement in the Sugar Vacuum Pan consists in a very skilful arrangement of the steam-heating pipes, by which a much greater extent of heating surface can be included within any given area, than can be accomplished in the ordinary way, and by which also the pipes can be got at much more readily when required to be repaired or renewed.

Fig. 1 is a sectional elevation of this improved pan, and fig. 2 a plan of the mid-piece when the pipes are fixed. At the two ends or sides, A A, the mid-piece is cast square, and into these ends are tightly ferruled a series of *straight* pipes *a a*. Figure 2 shows one-half of the top row of these pipes fixed in their places. B is the steam chamber for supplying steam to the pipes, and B^1 a similar chamber for the reception of the condensed water, which is carried off by a pipe.

By means of no more than two rows of pipes thus arranged, a heating surface of 120 feet can be attained in a pan of the usual size. When the pipes are required to be repaired or renewed, they

* The three angles of a plane triangle being proved equal to two right angles. See a demonstration of Euclid's 12th Axiom in Playfair's Notes on the 29th Proposition at the end of his Geometry.

Fig. 1.

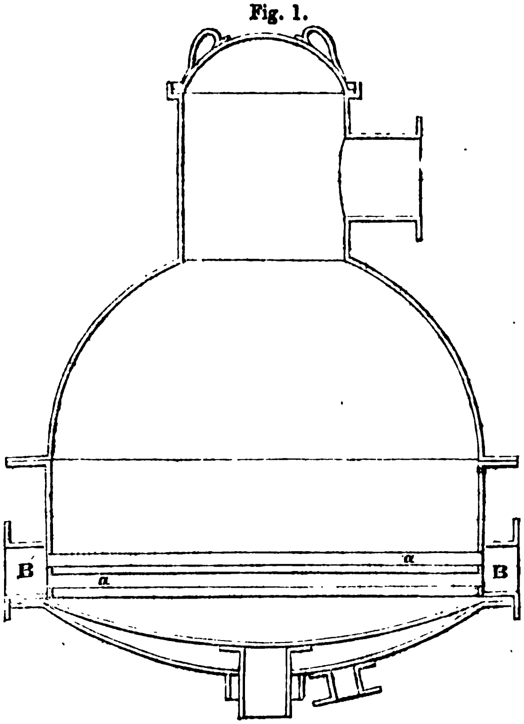
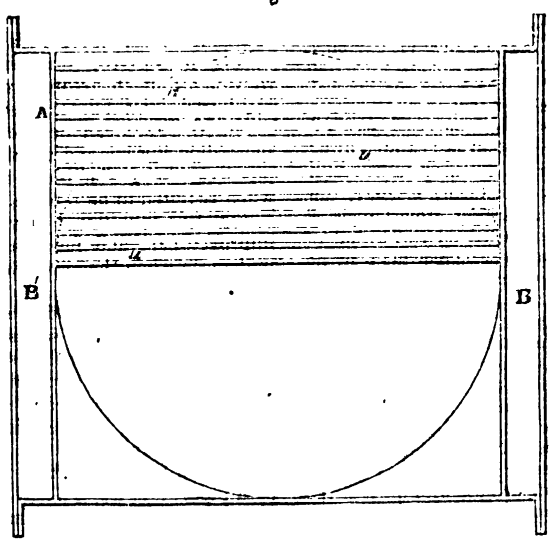


Fig. 2.



can be taken out by simply removing the ferrules on the outside without there being any occasion to take the pan asunder.

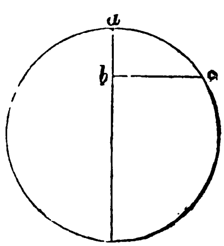
THE CRANK—LIPSCOMBE'S PATENT SUBSTITUTE.

Sir,—If the conclusion which "N." arrives at regarding the power of the crank, as compared with Lipscombe's patent substitute for it, be based upon, and deduced from, the process of reasoning which accompanies the description of that patent substitute in No. 1101 of the *Mechanics' Magazine*, there is reason to fear that the present "general opinion" respecting the crank, will still hold good. The very simple experiments, which "N." would make the practical engineering world believe, will "clearly prove that the crank does not transmit even so much as half the power expended upon it," are by no means suited to that purpose, or so conclusive as he thinks. The grand hobby of nearly all rotary engine constructors has been to avoid the use of the crank, and all the imaginary evils connected therewith. Few have attempted, and none have directly proved by direct experiment, any loss of available power when transmitted to a shaft through the agency of a crank, from the piston of a steam cylinder. The great blunder committed by those who appear merely to have stumbled against this subject, is in not considering all the circumstances of the case, and their mutual connexion, (of course it is not at all meant to insinuate that those who have thoroughly investigated this point have merely stumbled upon it.) What then are some of the more prominent circumstances which deserve attention in considering this important matter? Chiefly these,—that while the power applied either rises, falls, or moves in a straight line through a certain space, the crank in one revolution moves over a space as much greater as the circumference of a circle is greater than twice the diameter, that is, in the ratio of 3·1416 : 2.* If the power moved at an uniform rate, then the crank would be drawn or driven through the upper and lower parts of the orbit of its revolution with a much greater velocity than at the central parts; but as the power derived from the application of steam under a piston is not, and indeed could not be so applied that the piston should move with an uniform velocity—coming to a state of rest instantaneously, and returning in an opposite direction, and again, after passing over the range of stroke coming to an instantaneous stop, and so on—no materials, however strong, could stand the jar arising from such a movement. The crank appears to be one of those admirably well-adapted mechanical arrangements, whereby one natural law is thus made subservient to control another, which, when applied otherwise, is never very pleasant to look upon. In pumping-engines, for instance, where no crank is used, the shock which is produced at the end of each stroke has always an appearance of something defective, even although modified and reduced by spring beams or other contrivances.

To talk of the crank as leaving only "less than one-third" of the whole force applied to it as available—as well might "N.," or any other person, say that by Lipscombe's patent crank substitute not only is power saved, but actually gained. It is as easy for a mechanical mind to conceive a machine to gain power, as to lose it; both being alike impossible. A machine can do no more than transmit or direct. Mr. Russell has very clearly shown how the power is transmitted from the piston by the crank without any diminution, save a small per centage for friction, and rigidity.

It is, perhaps, after all, needless to have said so much respecting the theory of the crank movement, for, to come to what it would have been better to set out with, namely, practical experiment: if, from the pin of a crank upon a shaft with a fly-wheel upon it, a cord be led, either

* By referring to the following figure, it will be



seen, that while the power either ascends or descends through the short space *a b*, the crank has to move over the arc *a c*, which is much longer; and it can be demonstrated that the effective power multiplied into its velocity, or *a b*, is just equal to the effect produced into its velocity, *a c*. By thus dividing the whole circumference of the circle described by the crank pin, into a number of parts, and summing up the results, we shall find that the effect produced is equal to the power expended.

perpendicularly upward or downward, then passed through between two grooved pulleys with their axes parallel to the fly-wheel shaft, and a weight be attached to the end of the cord; and if the crank be then brought to the top or bottom centre as the case may be, according as the cord is led either up or down, then upon letting go the crank, it will be found that the action of the weight will be such, that the crank will very nearly ascend on the opposite side to the same height, from which it was let go; *directly proving* that the crank loses no power, save that small portion which is expended on the friction of the shaft and crank pin; and surely the friction of the patent substitute cannot be less in this respect.

You, Mr. Editor, must pardon my thus transgressing upon, and occupying so much space in your valuable Magazine, which perhaps might be otherwise better occupied; but practical men do not like to see the very fundamental principles of mechanics so abused as N. has done in the article alluded to. As to the patent substitute, no opinion is risked at the present upon it. N. and the author have it in their power very easily to satisfy themselves on that point by contrasting its effects when applied to the shaft of a small turning lathe, when the above experiment can very easily be tried at the same time.

Professor Airy, of Greenwich, has long ago demonstrated that the use of a short, instead of a long connecting rod, is a matter of no moment, so far as respects the losing of power thereby—and upon the general established rule of mechanics, that no machine can either destroy or augment any power communicated to it, the thing is perfectly clear. Of course, it is always understood that friction in a machine is no advantage, but a defect.

Yours respectfully,

S. M.

DESIGN OF A WIND HAMMER FOR BORING ROCKS. BY C. BRUNTON, ESQ., C.E.

I have long entertained a project for more expeditiously boring shot holes, especially in driving deep levels, by concentrating the power and operations of a number of men (say four or six) employed at a remote and well-aired part of the mine, in condensing air by an air pump, similar to that used for airing a diving bell. The condensed air conveyed by a small iron (gas) pipe to within a proper distance of the end of the drift, from whence conveyed by an elastic pipe to a small cylinder of 3 or 4 inches diameter, whose piston should be a hammer of about twelve pounds weight, which, moved at the rate of 200 blows per minute, and applied to an ordinary borer, held and turned by the miner as usual, would effect an expedition of great importance, in this most tedious and expensive department of mining operations.

But another effect would be produced, viz., by the condensation of the air, much of its latent heat would be given out, and being conveyed in this comparatively cool state, to the end of the drift to the work hammer, and being there discharged, would not only air the level, but supply the workmen with fresh and cool air, which in many of the mines in the county of Cornwall, would be esteemed an essential benefit. For this purpose I prefer condensed air to a vacuum, or rather exhaustion, which, if the object were merely to convey power would be a better application.

In either case, there is a considerable loss of power, but for the sake of applying the exertions of four or six men, to an object to which one man only can at present be applied, however urgent the necessity, would, I feel confident, well repay the loss.

Any mechanic well acquainted with the construction of the steam engine and slide valve, would be at no loss how to construct the cylinder and piston hammer,—the slide valve of which would, I think, be best operated upon by a boy, who would regulate the velocity, start and stop, under the direction of the miner. But the chief obstacle that presents itself, is the apparent difficulty of fixing the hammer in the positions required by the miner, which are indeed very numerous. To meet the difficulty, I have proposed to attach the cylinder longitudinally to the end of a piece of timber, by which it would be retained in the direction of its centre and the borer, and to support it in the position by resting it upon two pieces of timber, firmly wedged between the side wall of the drift.

By some such means I am of opinion, that the apparent difficulties would nearly vanish in practice under the hands of a miner, possessing a mechanical turn of mind, and some resources; for I believe that it will never be brought into practical operation but by such a person, encouraged of course by the parties by whom he is employed. That it may obtain the attention of such, I have taken the liberty of transmitting the communication, through you, to the Polytechnic Institution, and I would further express my opinion that were this project brought to bear, and holes bored with the rapidity due to 200 blows of a 12 lb. hammer per minute, a different adap-

tation of gunpowder would present itself, in boring a series of holes in the face of the end in line and contiguous; so that a shot in each alternate hole would so weaken or displace the rock, in the direction of the line of holes, (upon the principle of holing in coal,) that shot above or below that line, would be rendered much more effective.

In conclusion, I assure you that I am led to make this communication, in consequence of the extreme heat and unhealthy closeness, in which many of the miners are now working, which I would most gladly see alleviated, and if any of the influential mining captains take it up, I shall gladly and gratuitously give any advice or information in my power, in aid of its being brought into operation.—*Trans. Royal Cornwall Polytech. Inst.*, 1844.

MORE JANUS-SHAPED VESSELS.

[We quote from the *Liverpool Standard* the following descriptive particulars of two new vessels built by Mr. John Laird, of Birkenhead, which have been recently put on the Liverpool and Woodside station.]

Vessels having two rudders, to be used as occasion required, have before been occasionally tried, but with indifferent success—no previous plan of which we are aware having been practically developed, affording sufficient protection and steadiness against even slight collision with a seaway or a floating object, to the rudder which, for the time being, became the cutwater—the other acting in its capacity as a helm. Mr. Laird appears to have entirely overcome the difficulty that presented itself in this respect, so that the great desideratum in navigating narrow or confused channels—the immediate reversion of the vessel either end foremost, without backing, rounding, or loss of time—is effectually achieved. The vessels—the *Queen* and the *Prince*, each about 110 feet in length, 22 feet in beam within the paddle-boxes, and engines of 60 horses power, with oscillating cylinders—are of handsome model, sit on the water on an even keel, each end, when they are stationary, representing a fine bow with a sharp projecting cutwater, a portion of which, within the outer edge, is a moveable door, that may be instantly loosened to act as a rudder, or firmly fixed (when that end becomes the bow) by means of a dropping bolt, so as to complete and make good, even to a nicety of joint, the thin after portion of the cutwater. The great advantage over previous plans is that the outer edge of each bow-formed extremity, or cutwater, is of standard iron, sufficiently strong to avert the consequence to the rudder of the cable getting athwart hawse, of a bump, or running foul of any floating object, a pier or the like—which was generally fatal to the rudder in the former plans—and, at the same time, not so thick as to act to any conceivable extent as a stopwater when that end becomes the stern, and it stands abaft the rudder like a stancheon or outer sternpost. In the old plans, the rudder, which became the cutwater, was liable to be carried away on a slight concussion with any object, or even by the sea through which it was forced. In the present plan, the outer standing part of the cutwater evidently not only protects it from the first of these casualties, but ploughs a way for it, so that it is less liable to be thrust from side to side, or carried away in a seaway—a danger which is, of course, increased by the velocity of the ship. Mr. Laird, therefore, very appropriately denominates this main feature of his invention "a guard." To test the facility with which these vessels may be reversed in motion (with either end foremost), an experiment was made, while one of them was going up the river against a strong tide—the engine was stopped, and the bow-bolt drawn up, and the vessel, without turning, put in rapid motion down the river in fifty seconds. On another occasion, when going down with a strong stream, the same reversing operation being resorted to, she was making good way in the other direction against the opposing tide—which it, of course, required great power in the first instance to stem—in one minute and a quarter. Ordinary vessels would have had to make a long sweep round in either case, and would probably have required eight or ten minutes to accomplish the same object. The employment of these rudders would, doubtless, be of very great advantage in steam-ships of war, or exploring vessels, particularly gun-boats and tug-vessels, as by means of them they might run up narrow creeks or inlets, in which they had not room to turn or wear round, for purposes either offensive to an enemy or promotive of commerce. In accidentally taking the ground, too, they might the more readily steam off, as well as more safely thread their way in shallow and narrow waters. These new boats are very fast (ten knots an hour), and little or no difference is perceptible in their speed, whichever end goes foremost.

LIGHTNING CONDUCTOR AT THE NEW ROYAL EXCHANGE.

Sir,—I have read with regret the letter of Mr. Walker in your last Number (p. 175). I am not aware that any of my remarks on

the lightning conductor at the New Royal Exchange can justly be termed "condemnatory" of the plan there adopted; neither am I conscious of any expression that could justify the soreness evinced by Mr. Walker.

Having observed a disregard of precautions heretofore generally supposed to be essential to safety, I was anxious to know whether it had arisen from oversight, or if modern discoveries had really justified so important a departure from the beaten track. With all due deference to Mr. Walker, I maintain that "gratuitous opinions" *even when erroneous*, if they serve to elicit and to disseminate truth, cannot be "productive of much mischief." Indeed, Mr. Walker, above all others, should be the last man to stifle enquiry, or to cry down discussion on scientific subjects, knowing, as he well does, *how* large a portion of our present stock of knowledge we owe to freedom of discussion.

I beg to thank Mr. Walker for his references to the several works he mentions, from which it principally appears how largely we are indebted to the French *savans* for what little light has been thrown upon the subject of "conductors" since their discovery by the immortal Franklin.

Mr. Walker having written a popular article on lightning conductors, I think it a pity he did not quote the "few words" on *insulation*, as they might have furnished all the information I required, and at once disposed of the question.

There is another question I would much like to ask, it is this: If it be clearly established that insulation is not necessary, (?) why is the conductor at the Royal Exchange projected several inches from the wall, and thereby brought into needless proximity with the masses of conducting materials which occupy the tower in question?

Again, with respect to the conducting power of the copper rod, Mr. Walker states, that it exceeds the standard for such a tower by ½th of an inch. In constructing boilers, bridges, beams, chains, &c., it is deemed necessary to make them of a capacity greatly exceeding the amount of work ever likely to be required of them. Is electricity now such an *exact science*, that in fitting a lightning conductor to one of our most important public edifices, it is considered enough to provide ½th of an inch beyond the calculated standard of security? It seems to me, that if there were ever a case in which it was desirable to "make assurance doubly sure," it is in guarding against the destructive agency of that most mysterious and subtle fluid—lightning. However, I am glad to receive Mr. Walker's assurance that, in this instance, "every precaution which science can suggest has been taken." By the bye, science has suggested the employment of hollow perforated tubes in preference to solid rods, as reducing the weight of metal, and at the same time greatly increasing the amount of conducting surface; has any countervailing effect been found to negative these advantages?

When we reflect how little we really know of the nature and operations of the electric fluid, and what a vast unexplored region lies before us, it behoves modern professors to moderate their displeasure towards enquiring tyros, remembering that it sometimes happens that, the most learned men commit the most egregious blunders.

Patiently awaiting Mr. Walker's promised publication, when all the details of the conductor shall be completed,

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington,
Sept. 21, 1844.

P.S. Since the above was written, your Magazine of the 14th has appeared, containing a communication from Professor Murray, by which it appears, that the *best form* for lightning conductors is a matter about which doctors may *still* disagree. I need hardly add, that with Professor Murray's views I most cordially agree.

NECESSITY OF COMBINING VENTILATION WITH WARMING IN FACTORIES, DWELLING-HOUSES, ETC.

[From Observations on the Sanatory Arrangements of Factories. By Robert Ritchie, Esq., C.E., F.R.S.S.A. Read before the Royal Scottish Society of Arts, Session 1844.]

About the beginning of the present century, the mode of heating mills with steam was introduced in England by the late Mr. James Watt, and in Scotland by Mr. Neill Snodgrass.* This method of heating in a few years became general, and led to the almost entire discarding of stoves; the chief reasons assigned for the preference of heating with steam-pipes were, its greater safety and cleanliness.

The late Mr. Robertson Buchanan, C.E., whose essays were published in 1810, and a subsequent edition in 1815, was one of the first writers in favour of heating mills by steam. The plan he strongly recommended for cotton and other factories, was to place the steam-pipes within work-rooms, and elevate the temperature of the room by means of the surface of the pipe, in a similar manner as hot-houses, conservatories, and dry-

* This was in 1799, but it had been previously tried by Mr. Watt in 1785. The plan of heating by steam was first described in the *Philosophical Transactions* by Colonel Cook, in 1745.

ing-rooms are now done; this was the plan first introduced for heating factories with steam-pipes, and still continues in general use. The late Mr. Tredgold and other writers have likewise written in favour of heating by steam-pipes.*

It is somewhat singular, that Mr. Buchanan took the view he did of heating factories by steam-pipes, as he informs us, he did much to introduce into Scotland the Belper stove—the invention of the late William Strutt, Esq., of Derby—having heated several cotton-mills with these stoves about the year 1810. The Belper stove was applied so far back as 1792 to heat the first fire-proof cotton-mill erected in Britain. This plan of heating was, however, little known to the public till the publication of *Sylvester's Domestic Economy* in 1819, describing the Derby Infirmary. These stoves, however defective they may now be considered, when contrasted with modern improvements in artificial warming of atmospheric air, will by many be admitted to be the foundation of many recent plans of warming and ventilating.

The method of combining ventilation with warming, which seems to have received so much careful consideration, appears to have been entirely overlooked in the new plans of heating factories with steam-pipes. When steam-heat was made use of, the desideratum was to attain regularity of temperature in the most certain manner. Mr. William Strutt, whose useful inventions are well known, entertained a very opposite idea to this; he preferred combining air with heat, or in other words, warming the atmospheric air moderately before admission into the factory. A description of his method of warming the Belper mills was many years back given in *Rees' Encyclopedia*, and I found the plan, at a recent visit I made to Belper, still continues in nearly its original form; the air is warmed in a chamber by means of a stove of large surface to prevent injury to the purity of the air, and enters by conduits the different floors of the mill, while corresponding ones permit the escape of the vitiated air. I have observed cotton-mills were all formerly heated with stoves, they were usually made of cast-iron, and placed on the basement floor of the building, the air being heated by passing over these, often at a red heat, and conveyed by flues to the work-rooms. This old plan of heating is still retained at one of the oldest and most extensive mills in Scotland, and a few other places. The object Mr. W. Strutt sought after, in the introduction of the Belper stove, was to prevent injury to the atmospheric air, when impinging in the process of heating *against overheated surfaces;* and from the experience he must have acquired and his inventive turn, he was one likely to adopt those improvements both in warming and ventilating buildings, which have been introduced since the period the Belper mills were erected, which are now of old date. For there can be no doubt that the plan of *physical ventilation*, adopted by Mr. Strutt, is by no means of that certain character to make it to be at all times depended on, and very inferior as repects certainty of action to the artificial, or mechanical movement of the air. As it is, however, Mr. Silvester made the remark in 1819, *that "the purity of the air* of the Belper mills *was strikingly different from that experienced in cotton-factories heated by steam, arising from the want of ventilation in the latter, for which no provision is made."* This is in other words, that there was a marked difference in the purity of the air of a factory in winter which was heated by means of the introduction to it of *moderately heated air*, from *that* which was heated as *a green-house*—with steam-pipes passing through it. This is a point of very grave importance; if the observation is correct, as *regards the principle*, there is no alternative but returning to the system of warming which will ensure purity of the air combined with heat; if it is wrong, it should be clearly established that heating factories with *steam-pipes like hot or drying-houses*, is the best for salubrity. *This question cannot be easily evaded, as it is pregnant with importance to the health of thousands of the workers in factories, not merely in the United Kingdom, but in other nations of the world.* The solution of this question cannot be of difficult attainment—practice is indeed nearly all on one side; still, the universality of the custom cannot establish its salubrity, though it may show its convenience. One would think that giving *supplies of heat* without *supplies of fresh air*, to apartments occupied by human beings, was the most preposterous of all absurdities. For the human frame can no more bear long immersion in a close elevated atmosphere, without injury to the vital functions, than to be deprived of aliment to sustain it. From noxious exhalations increasing with heat, one may easily surmise, that the elevation of temperature arising from the surface of steam-pipes at 212°, placed in close rooms, must soon render them *sickening and unwholesome*. The effluvia from the oil by the friction of machinery, and from vegetable matter, conjoined with the constant extrication of matter from the living body, are all

* Mr. Tredgold's work was published in 1824.

rendered more pernicious upon the same principle as fermentation goes on in a hot-bed. Surely it requires no reasoning to prove what must be so self-evident. If people could live in highly elevated temperatures without a constant renovation of air, it might be the easiest thing possible to keep them in any degree of heat they might require, from 60° F. upwards.* But the most robust constitution must soon be brought low, if confined from day to day, and year to year, in a *stagnant, highly heated atmosphere.* It then becomes a matter of absolute necessity that means be taken in close work-rooms to keep up the temperature and renew at the same time the atmosphere; for without this is done, the salubrity of the factory cannot be attained.

It has been stated, and few will deny that, with some exceptions, the present system of ventilating and heating of factories is very defective. As respects the modes of ventilating nearly in all the factories in Britain—it is carried on merely by means of *opening a pane of glass*, or *a small portion of a window*, and heating the room, as has been observed, by steam-pipes, which usually pass longitudinally, about a foot below the ceiling of each apartment, over the heads of the workers.

I need hardly, after so much has been said and written by medical writers on the subject of ventilation, point out the *absurdity*, if not danger, of confiding *alone* to the use of windows as the medium for ventilation of close *crowded* apartments.† It is a well-known fact, that the *higher* the heat of the room, the more offensive the cold current entering from the window must be in chilling the body and inducing disease. As respects factory-work, keeping the body boiling at the head and freezing at the feet is *incidit in Scyllam cupiens vitare Charybdin.*

In almost all factories, the ventilation has not been combined with the warming process, or air inlets provided; hence, the air is allowed to find its way at the crevices of doors or windows; the latter may indeed remain open in mild weather, but in winter the effect of this would be to lower the temperature too much, even were it submitted to, to permit the work to be carried on. In truth, if we are to judge from the almost universal practice the plan of heating with steam-pipes placed in work-rooms seems to find few objectors, and the air entering by chance at an open window appears to be thought sufficient.* Such being the fact, one is placed in rather an ungracious position, when attempting to correct errors or point out fallacies in plans of warming and ventilating, which have not attracted the attention of those more immediately connected with mills; but when the object is merely for the sake of the health of others, apology cannot be required. Seeing the universality of the practice, one might be distrustful of his own judgment in giving a preference to other warming and ventilating arrangements. I was the more pleased, therefore, when I found recent improvements based on the principle of uniting warmth with ventilation, introduced at one of the most extensive flax-mills in England. The very large work-room of one floor is thoroughly supplied by numerous apertures at the floor with fresh air, regulated in temperature and moisture before admission to the room in a chamber of preparation.† A great expense has been gone to, entirely for the ventilation. A steam-engine of eight horses power is made use of for injecting the air into the vast apartment, by means of a powerful wind-fan, by which a current is produced, and the vitiated air is forced out at the numerous roof-lights above. This plan of warming and ventilating was long since recommended by Dr. Ure: he observes, "On every principle of sound physiology, we ought to increase the density and spring of the atmosphere, by throwing in a constant current of pure air, brought to a proper degree of temperature and moisture, instead of having recourse to chimney draughts, which operate by pumping out, exhausting, or attenuating the air."

This example I am glad to refer to, as illustrating a principle which might easily be still more extended at all factories. There can be no doubt the salubrity of the em-

* The Russian and German plan of heating by means of hot surfaces in rooms, has frequently been tried to be introduced into this country, but fortunately, as yet, as respects health, unsuccessfully. Count Rumford wrote in favour of it, and more recently, Dr. Arnott recommended his stoves in place of open fires. But the fallacy of these plans, so injurious to ventilation in domestic dwellings, has been ably pointed out by Dr. Ure, Mr. Jeffreys, and other writers. The effect of heat is different according as it is produced.

† Windows in ordinary dwellings are very simple ventilators, and may be used safely even in winter by opening the window of one room and sitting in another, and *vice versa*; much advantage could be derived in summer in some buildings, by attention to the opening of the windward or leeward windows, as circumstances require.

* I need hardly observe, that in cases where ventilation is *unimportant*, it must be obvious that the plan of raising this heat from the hot surface of steam or hot-water pipes placed within the apartment, may be useful and free of risk from fire; but there will be great difficulty always experienced in combining such a mode of placing pipes with a constant renovation of air.

† At this mill they partially heat by steam-pipes in the room, over the heads of the workers, which I dislike. The hygrometrical condition of the air of the room is carefully attended to, a point of great importance for salubrity.

ployment must be improved by such effective means of ventilation, and without wishing to draw invidious comparisons, the general health of those employed at this factory seemed good, and their appearance in their favour. Of course there may be other mills equally well ventilated as the one referred to, but there were few, or none, which I could hear of, where mechanical means had been adopted for the general ventilation of the buildings. The wind-fan is in use at Manchester and other places in factories, but it is chiefly confined to the ventilating of closets.

The ventilation of factories by mechanical means being the exception and not the general practice—it becomes an important consideration as respects the health of workers, if it should not be generally extended to all mills, for there can be no doubt, no buildings afford so much facility for applying such methods for their thorough ventilation, as a motive or impelling power is always available.

In my original paper* I have given ample evidence from numerous medical and scientific men, (as well as from the evidence taken before the Select Committee of the House of Commons a few years ago,)† that the ventilation should be combined with warming, not separated from it; and, secondly, that the impure or vitiated air should be withdrawn from the ceiling upwards, so soon as generated. As respects the combining warming with ventilation, this is best effected by having the atmospheric air moderately warmed in large volumes before admission in winter to occupied apartments, and affording continual supplies of pure fresh air, by which means it can be regulated in humidity, affording constant supplies of air as well as warmth. It is placed in contradistinction to the system of steam-pipes or hot surfaces in rooms, which have the power of heating but not ventilating, and which have no relation to the purity or impurity of the air to which they impart heat, and which afford no ventilation, and therefore are injurious. As far as health and comfort are concerned, heating and ventilating should never be separated. When heat alone is carried out from hot surfaces in rooms, currents of cold air must be supplied to change the air in apartments. "It is manifest," says one writer, "that the best principle must be first to heat the required volume of fresh air, and then introduce it to the apartments to be heated and ventilated, instead of effecting the double object by two distinct processes."

(*To be continued.*)

* For an abstract of this paper, see *Mech. Mag.*, Vol. xxxix, pp. 418, 438.

† The advantages which have been derived from warming and ventilating many public and domestic buildings, on the principle of the introduction of a large volume of fresh air, regulated in temperature and moisture, and the removal of vitiated air, point out the utility of extending this principle, but all expensive and complicated arrangements however should be avoided, and are unnecessary. Much has been said tending to create the idea, that the method of warming air in a chamber, as practised at the House of Commons, is a new invention; this is not the case, as the hot-water apparatus, nearly the same as now in use, was on the spot before the present alterations commenced. I myself have employed this mode for many years. In 1832, I brought this subject under the notice of the R. S. S. of Arts, for which the Society's honorary medal was awarded me.

NOTES AND NOTICES.

Great Produce of Pig-Iron.—At the Langloan Iron-Works, near Airdrie, there are three blast-furnaces, belonging to Messrs. Addie, Miller, and Rankine, which produced in one week 595 tons of good saleable iron; this is at the rate of 198 tons per furnace, and it is believed that the like was never done by any furnace in the kingdom. The ore used is the famous black-band ironstone of Lanarkshire, and the coal, that known as the Glasgow splint seam. The furnaces are 42 feet high from the top of the hearth to the filling ports, and 16 feet wide at the bushing.—*Mining Journal.*

Antidotes for Arsenic and Corrosive Sublimate.—Professor Murray, in a letter to the *Mining Journal*, observes, "an antidote for arsenic (arsenious acid) had long been a desideratum; happily, that interesting discovery has been made these several years past, and yet is far from being generally known. *Hydrous peroxide of iron* is that valuable remedy; and I can safely assure you, from oft-repeated experiments, that this antidote is a *specific*. By referring to the red ochrey desposit connected with the water issuing from a chalybeate spring, you will know what I mean; this substance, under the name of "reddle," is sometimes used to mark sheep; and what is called *crocus martis* is a peroxide of iron. I have given to one animal what would have destroyed several; but when the hydrous peroxide of iron was administered at the same time, or in a reasonable period afterwards, the poison was perfectly inert. This remedy was announced from Germany; but the scepticism with which it was received in this country almost exceeds belief. In cases of poisoning by arsenic, the stomach-pump is of no avail. I have discovered, moreover, that the hydrous peroxide of iron is also an antidote to *corrosive sublimate*. I prepare this antidote by precipitating the oxide of iron from a solution of sulphate of iron with caustic potassa; the precipitate is easily separated by the filter, and, when washed, and exposed to the atmosphere, it will soon assume its characteristic redness."

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1103.] SATURDAY, SEPTEMBER 28, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

IMPROVED HAND BRICK-MAKING MACHINE.

Fig. 1.

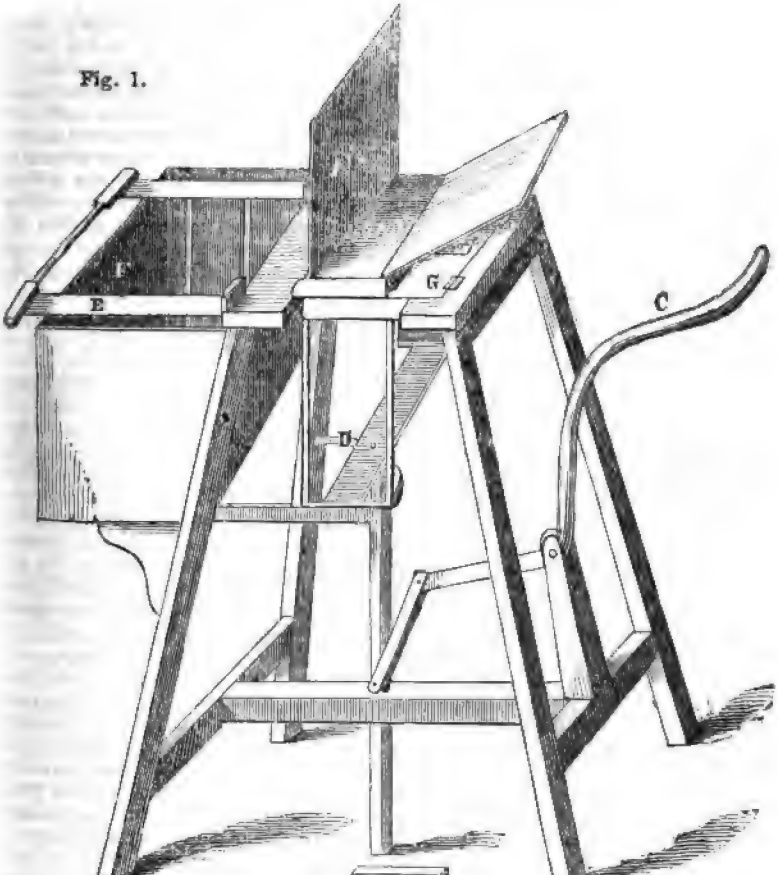
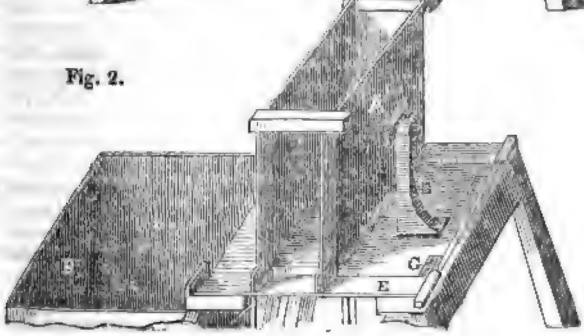


Fig. 2.



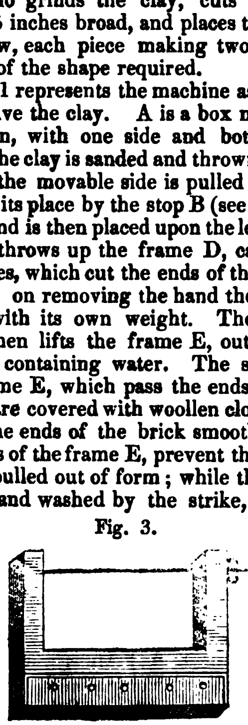
IMPROVED HAND BRICK-MAKING MACHINE.

Sir,—The accompanying sketches represent an improved machine for making bricks by hand, which I have lately constructed and found to answer so well, that I am desirous of making it known through the columns of your useful Magazine, in order that others may participate in its advantages. It makes a very superior brick for facing walls, and is also particularly well adapted for making ornamental bricks, for coping walls, and finishing the gables, chimneys, and windows, of cottages and houses. One man and a boy can finish 1,000 bricks in a day. The bricks, too, are stiff enough to bear piling in walls, whereby all risk of damage from rain is avoided.

Ground clay is used. The opening of the clay mill, when grinding for bricks, is 10 inches by 6, and there is a wire stretched lengthwise across the opening, which cuts the clay into two slices. The man who grinds the clay, cuts it into pieces 5 inches broad, and places them in a barrow, each piece making two clods, nearly of the shape required.

Fig. 1 represents the machine as ready to receive the clay. A is a box made of cast-iron, with one side and both ends open; the clay is sanded and thrown in, on which the movable side is pulled up and held in its place by the stop B (see fig. 2). One hand is then placed upon the lever C, which throws up the frame D, carrying two wires, which cut the ends of the brick square; on removing the hand the frame drops with its own weight. The other hand then lifts the frame E, out of the tub F, containing water. The sides of the frame E, which pass the ends of the brick, are covered with woollen cloth, and wash the ends of the brick smooth; and the tops of the frame E, prevent the brick being pulled out of form; while the edge is cut and washed by the strike, fig. 3,

Fig. 3.



which has a wire on one side, and on the other is covered with woollen cloth. Figure 2 represents the position of the mould when the brick is finished. To take the brick out, the end frame E is thrown back into the water; the stop B is put down; the jointed side then falls open, and a boy comes with a pallet and places it against the open side of the mould, while, with the other hand, he lifts the mould up on the back side, it being jointed at C; the brick falls on the pallet, and is placed where it is to dry.

When ornamental bricks are made, the box A must be altered to the shape of the required brick, and instead of using the end cutting and washing frames, the wired strike, fig. 3, must be employed.

I remain, Sir, yours, &c.

Mansfield Harrison.

Keyingham Marsh, Hedon,
Sept. 14, 1844.

THE ARGAND FURNACE.—"IGNIS" IN REPLY TO MR. DIRCKS.

Sir,—Not having any intention of getting into a controversy with Mr. Dircks, or any other *combustible* gentleman of his calibre, as to Mr. Williams's inventions, or assumed inventions, in caminology, upon which there has been already so much conglomerative, though to the parties interested, no doubt *valuable* ink shed,—I have only to remark, that his letter of July 30, 1844, which purposes to controvert the statement made by me in a previous Number, to the effect that Mr. C. W. Williams is not *the first* inventor or designer of the method of getting rid of smoke by admitting a *certain* or *determinate* volume of air through comparatively *small* apertures to *mix*, or diffuse, as Mr. Williams calls it, with the combustible gases, as completely as possible, but that, on the contrary, so far as yet appears, M. Virlet is the true and first public describer of this method, as of one previously in use—Mr. Dircks' letter, I say, though full of windy words, does not contain one syllable in contravention of this. It is absurd to object that I have quoted M. Virlet at length, and have not done so by Mr. Williams, when all that the latter has done or proposed has been printed in the *Mechanics' Magazine*, and almost

every other periodical in Great Britain, until his inventions and discoveries had become nauseous by repetition. But what is there needful to quote?

Virlet says, to produce combustion in his furnace without smoke, you must admit by certain comparatively small apertures, the more numerous the better (that is to say, the smaller each hole with a given total area), a determinate quantity of air—that these apertures must be at the throats of the furnace (*i. e.* just where the flame leaves the body of fuel)—that if too much air be admitted, loss of heat will follow; and if too little, smoke will be produced—and that the air and combustible gases must be *mixed* as much as possible.

Now will any man (not an interested partizan) stand up before the public, and affirm that this does not include every thing that is of the smallest value in all that Mr. Williams has invented or written upon the subject?

Nay, further, will any man who has read and understood Tredgold's book on Warming, &c., venture to say that *he* did not fully perceive and state that a determinate volume of air is requisite for the combustion of a given weight of coal?

The fact is that Mr. Tredgold actually states *in figures* "the *certain* quantity" of air for combustion of a given weight of fuel, and has defined it just as *scientifically* as Mr. Williams has done, and without that parade of science which characterizes his treatise "chemically and practically considered."

As to Mr. Dircks's competency to judge of his patron's chemical acquirements, it may be judged of by his present assertion, that *carbonic oxide* is the only gas given off by timber when burnt.

But, Sir, I have no wish to deprive Mr. Williams of any of the merit which justly belongs to him, and which I have endeavoured to award him, as the author "who has more fully insisted upon the known principles of burning coal than had been before done." If Mr. Dircks thinks there is *no merit* in this, I cannot help him; but nevertheless I think there is, and further that there would have been a great deal more if the author had ingenuously given due merit to those who preceded him, especially Tredgold, from whom some garbled quotations are made to show how wrong he was, and how little he knew, and so forth, while *all* those passages are suppressed which would have shown that Tredgold saw the whole subject of good combustion in furnaces clearly—knew quite enough of chemistry to apply it accurately to his subject, and was too simple-hearted a man, and too intrinsic a genius, to parade more of it than he wanted.

Tredgold's book is to this hour the best book in existence upon the subject of combustion of coal in furnaces, &c., and one which a practical man can really understand and use; while, notwithstanding Mr. Dircks's eulogium or advertisement, whichever it is, that Mr. Williams's "brings home this difficult subject to the plainest comprehension, so that the practical mechanic may read and learn important scientific facts in a new, plain, and simple dress," it is a book which is absolutely unintelligible to any practical mechanic from its pompous display of needless chemistry; and, what is worse, is mischievous on account of its imperfect and superficial statements of this very chemistry which it so much meddles with.

One word for Mr. Dircks, and I have done. I have said, "Virlet clearly recognizes the principle of *dividing* the streams of *mixing* air and gases," and I repeat it. Mr. Dircks responds by defying me to point out the recognition of this principle in any of Mr. Williams's writings. This is paltry quibbling. Mr. Williams's patent for admitting the air through *numerous small apertures, does, as a fact, divide* the streams of air; and although possibly the words "divided streams of air" may not occur in Mr. Williams's writings, nor mixing of air—for he loves to talk of "diffusion of gases," as more scientific—(although, unfortunately, peculiarly wrong and astray in the use of this same word as applied to the mixing of gases in his furnaces, where no *diffusion* whatever is possible, in the proper sense in which the word was first used by Professor Graham)—still I say that the thing signified, viz., the mixing up of the air and combustible gases, while hot enough to burn, is as fully recognized in Virlet's memoir as it ever was by Mr. Williams; and it is laughable to find Mr. Dircks himself using these very words almost, as reported in the proceedings of the British Association at Cork last year.

Again I repeat, perfect combustion of coal in furnaces is a humbug; and for

the simple practical reason that I have given, and which Mr. Dircks does not make even an attempt to contravene, namely, that with *any* arrangement or contrivance of furnace the appearance of smoke is at the mercy of the stoker, and of a hundred little contingencies, that together, make a smokeless furnace too nice an instrument for vulgar use.

Any furnace whatever, of common construction, and moderately well-proportioned, under a boiler, whether with Mr. Williams's contrivances or not, may be made by a proper adjustment of the air admitted to the fire, to burn for a while without smoke; but, alter the "regime" in the least—throw on a mass of cold fuel—let ashes accumulate—let the flues get foul—nay, let the barometer rise or fall an inch or more, or the wind shift much in direction, or vary considerably in intensity—and without fresh adjustments and renewed care, Mr. Williams's own arrangements will be found, as regards "perfect combustion," a humbug. Mr. Williams's plan is good, because it gives facility to these adjustments, and renders them less frequent, and, when applied to most common furnaces, less necessary; but it is a humbug to affirm that it confers of necessity the power of perfect combustion, or that furnaces on his plan are necessarily and permanently "smokeless," or that there is the least resemblance between their working and the burning of an Argand lamp, as is pretended by this title being given them—the mass or volume of fuel (in whatever state) and draft in the furnace being subject to momentary change, and alteration of condition, whereas in the Argand lamp, once lighted, the supply of fuel is unvarying, and the draft sufficiently so to ensure nearly perfect combustion, without any of that incessant attendance which is indispensable to keep any furnace consuming coal, however constructed, always free of smoke; and which, as I have said, will make the Smoke Nuisance Bill, if ever passed, and enforced, an infinitely worse nuisance to the manufacturers than ever the smoke itself was.

Although unknown either to Mr. Williams, or his advocate, Mr. Dircks, and writing upon a subject upon which I take very little interest, yet, as I have been accused by the latter of personal motives in having asserted Virlet's claims to priority, and of having, as he *eloquently* calls it, "dismantled, disfigured, and defamed" Mr. Williams, I have deemed it right thus to sustain the remarks I first made, with no other desire or intention than that which should be always present in the breast of every real cultivator of science or art, namely, to award where it is *really* due, the merit of original discovery or invention, and where, as in this case, accident has led to the discovery of a prior inventor, to assert his claim to whatever merit the invention may possess, against a probably independent, but unquestionably a second and later inventor. This may be "dismantling," but, unless coupled with a charge of plagiarism, it is not "disfiguring." I have made no such charge against Mr. Williams as regards Virlet, and if I had done so, unless proved false, it would not be "defaming." Mr. Dircks, therefore, writes on the plan of many an orator and scribe, who fancies that a sentence is like a drum, so as it be round, and sound big and thundering, it matters little how empty it is; indeed, the latter characteristic belongs to his whole communication. I hope, however, here to wish good-bye to him and the subject, and am, Sir,

Your obedient servant,

IGNIS.

September 16, 1844.

THE CALCULATOR, NO. XIII.—ON THE FINANCIAL ECONOMY OF SAVINGS BANKS.

The recent Act concerning Savings Banks, in which so large a sum has been invested, ought to occasion close inquiries into the constitution and management of each. The principal feature of the new law is a reduction in the rate of interest; but it is not so much on account of this, as of the greater scope for good management which is now conferred, that I am induced to take up the pen. Hitherto the legislature has compelled all managers to retain out of the interest allowed by Government 7*s.* 7½*d.* per cent.; and if that sum was more than was required for the expenses of management, they were obliged to pay the surplus back again.* In future they will be allowed

* Nominally, this surplus still belongs to the bank which pays it in; but no interest is paid upon

to give all the interest to the depositors, except 4*s.* 2*d.* per cent., if they can bring the expenses within that amount. Very large banks ought unquestionably to do this; those of small capital certainly will not be able, unless their expenses be in part defrayed from some other source. But with the greater number of banks it ought to be a matter of careful investigation, how nearly they can approach to the allowed maximum of 3*l.* 0*s.* 10*d.*

It appears to me that the machinery of a savings' bank is sufficiently simple to admit of the subject being handled algebraically; probably it is the first attempt of the kind.

I suppose a bank to have at the beginning of the year a certain sum invested with Government, and a much smaller sum in the hands of the treasurer (a limit being put to these by the rules). The latter sum will consist in part of a management fund, and the remainder will belong to the depositors. I suppose also that the receipts and payments in the course of the year will pretty nearly keep pace with each other, and that after paying the expenses of management for the year, the management fund will at the end of the year remain untouched.

Put r', the annual interest of 1*l.* allowed by Government.

r, the like, to be allowed to the depositors.

f, the management fund at the beginning of the year.

h, the investment with Government.

$f + h\,e$, the money in the treasurer's hands, not producing interest.

$h(1+e)$, the depositors' capital.

$p + hq$, the year's expenses of management.

n, the profit obtained by the bank by the course of dealing.

Required the value of r, all the other quantities being given?

Answer.—The increase of capital at the end of the year will be $hr' + n - (p + hq)$, and consequently,

$$r = \frac{hr' + n - p - hq}{h(1+e)} = \frac{h(r' - q) - p + n}{h(1+e)}$$

Now, since e, n, p are all very small with regard to the whole denominator of the fraction, e may be neglected in that part of the fraction in which p and n are numerators, whence we have

$$r = \frac{r' - q}{1+e} - \frac{p - n}{h}$$

Example taken from the actual data.

$$h = 44000,\ e = \cdot 0075,\ p = 60,\ q = 002034,\ n = 35\cdot 5,\ r' = \cdot 032764.$$

$$r = \frac{032764 - \cdot 002034}{1\cdot 0075} - \frac{24\cdot 5}{44000} = \cdot 030501 - 000557 = \cdot 029944 = 3l. \text{ per cent. very nearly.}$$

And we derive from the formula this: that if p and n were equal, r would be invariable; but if n be less than p, as I imagine must generally be the case, r will vary in the same direction as h; that is to say, that, *the larger the capital of the bank, the higher the rate of interest they can afford to the depositors.*

This last observation should be looked upon as an axiom with regard to savings banks in general. It arises from the form of the expression $p + hq$, given above for the expenses of management; with regard to any particular bank, p and q ought to be constant quantities.

The other quantity, n, by which I have designated the profits (independently of interest) obtained in the course of dealing, requires, perhaps, to be further explained, seeing that it evidently influences the depositors' rate of interest. I must reserve this for another communication, and remain, Mr. Editor,

Yours truly,

J. W. WOOLLGAR.

Lewes, September 22, 1844.

MR. MALLET'S AND CAPTAIN NORTON'S PERCUSSION SHELLS.

Sir,—I feel it necessary to reply to Captain Norton's letter of the 14th ult., in your Journal, referring to my percussion shell, figured at page 88 of the same monthly part, first, because Captain Norton's memory has very much failed him in respect to the events he describes; and secondly, because his letter leaves wholly unanswered the question I took the liberty of putting to him in my communication to you of the 2nd ult.

I beg, then, to state that at the period alluded to by Captain Norton, when I

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it, and it is apprehended that the Government would not part with it easily, notwithstanding the provisions of the Act 9 Geo. IV., c. 92, s. 23.

showed him and his friend Major Cottingham my percussion shell in 1832, the first shell of the sort I had ever made was the one which I exploded for them. It exploded at the second fall from a height of 14 measured feet; and the cause of its missing on the first descent was that in this first shell the iron plug (*e*, see fig. page 88) was suspended in its tube by a bit of packthread, in place of the spring afterwards adopted, which gave too much resistance to the liberation of the plug.

As Captain Norton's memory has been accurate as to this trifling circumstance, I am the more surprised at his statement, that I "did *not* explain to him the interior contrivance;" thus leaving it to be inferred that he knew nothing of the plan of my shell until he saw your last monthly part. I beg most positively to affirm that I showed in my own laboratory, both to Captain Norton and his friend, the whole internal and external construction of my shell on the same evening that I exploded the one above alluded to for them.

Captain Norton has, therefore, been since 1832 fully in possession of my invention for exploding shells by percussion, by the principle of the inertia of an internal loose piece, from my own personal communication, and this independently of my publication of the whole arrangement in your Journal, in September, 1832.

It appears that Captain Norton assumes to be the inventor of two sorts of shells; one for exploding at the bottom of the sea, which he calls his *percussion* shell; the other, which it appears has been tried at Woolwich, and pronounced fit for horizontal fire at high velocities, and "safe, simple, and efficacious"—he calls his *concussion* shell. Now, if I am rightly informed, the principle of both these shells is alike, and they are both identical in principle, and (if not wholly so, all but) identical in actual construction with those figured and described by me in your Journal in September, 1832, or just ten years before Captain Norton's assumed invention of them was brought forward.

I beg, Sir, therefore, respectfully to ask Captain Norton to state distinctly in your pages, what is the principle and construction of his concussion shell, as tried at Woolwich, for horizontal fire, and how it differs from mine?

I presume the construction of his shell can be no secret now, and that therefore there can be no difficulty in his doing so on this score.

Let it, therefore, now be understood that we are not talking of submarine shells, or shells for protecting houses, or of any of the many other irrelevant topics with which Captain Norton's letter of the 14th ult. appears to be filled, but that the point at issue between Captain Norton and myself is simply this—Is his shell, as tried at Woolwich, and favourably reported on, which is contrived to explode on striking an object, the same *in principle*, and more or less in construction, with my shell described in your Journal in 1832? To this question Captain Norton will no doubt perceive the necessity of giving a frank and distinct reply at his earliest convenience in your pages; pending which, I am, Sir,

Your obedient servant,

ROBERT MALLET.

ON THE EMPLOYMENT OF AMMONIA IN THE PREPARATION OF STARCH, CLEANSING OF RICE, FLOUR, ETC.

Sir,—I respectfully request your publication of the following communication, which I consider may be found very useful to the public.

About three years since I made some experiments on the manufacture of starch and preparation of farinaceous matters for food, and I found, that for all practical purposes, liquid ammonia is the best agent for dissolving gluten and the colouring matter and soluble impurities of wheat, flour, rice, peas, potatoes, or any article containing starch, inasmuch as it acts powerfully on the gluten and colouring matter, while it has no action whatever on pure starch. Liquid ammonia of the specific gravity of 0·945 will be found a very good strength, and is superior to either soda or potash in a caustic state, as strong solutions of them act powerfully on the starch as well as the gluten.

In the preparation of articles of food, it is also found an excellent agent, as it extracts from all farinaceous matter any astringent matter contained therein, leaving the fibre and starch untouched. The fibre requires only to be separated for the purpose of making starch in the usual way by straining through a fine sieve. It

may also be applied in the gaseous way by passing it through refrigerators into vessels containing the matters to be acted on, just wetted, so as to absorb the gas; and thus the ammonia from gas liquors, or any other source, may be used, as a perfectly pure ammonia is not absolutely necessary for all purposes.

The ammonia, when saturated with gluten, is easily recovered by redistillation, when it may be carried on to fresh matters, or condensed into the liquid state, and the gluten be applied to any purpose for which it may be found useful, as it does not so readily ferment when treated with the ammonia.

I have found that farinaceous matter—rice especially—is not injured by being *kept* in ammonia for any length of time, and that the starch so made, after washing out the gluten, is not liable to ferment in the process of drying, especially if a little ammonia be left in it, as it dries more rapidly in that case. It is also an improvement to add a little ammonia to starch, under any circumstances, as a finishing process, even if the starch has been made by the usual process of fermentation, or by the use of very dilute solutions of soda or potash. I have also found the inferior kinds of rice and peas, and other grains, rendered equal in quality and flavour as articles of food to those of the best quality, after having been steeped in ammonia and the impurities washed away.

Close vessels are the best for conducting the operation, and in some cases a low degree of heat may be used without any injury; but this is not necessary, as the cold operation is sufficient for all practical purposes.

I am, Sir, yours, most respectfully,

E. Nash.

28, Duke-street, Stamford-street, Blackfriars'-road.
September 17, 1844.

P.S. Ammonia will also be found superior to potash or soda for removing glutinous matter from vegetable fibre in the manufacture of woven fabrics and in other cases.

CAPTAIN WARNER'S INVENTION.

The truly incredible part of this gentleman's promises of destruction, consists in the assertion of his possession of a *projectile* range of five miles. That this constitutes part of his offer of experimental proof seems to be assumed on all hands; but I would beg to ask whether *Captain Warner himself ever stated in so many words, that he possessed the power of throwing a projectile to this or any other distance.* I think not—on the contrary, his most explicit and direct offer, is couched in the doubtful words, "I *will*, from on board a ship, destroy another at the distance of five miles." This looks very like deception, and as if that which all the world is racking its brains to make out, namely, his means of *projection*, were, after all, only a mode of *floating*, or letting *adrift with the tide*, his invisible shell against the ship to be destroyed — invisible, because simply it is a little under water. Thus, with equal truth and ease a man might say, "I will stand on London Bridge and destroy a ship at the great Nore."

It is pitiable to see the enormous waste of time, ingenuity, and trouble, spent upon devising means for Captain Warner to do what he never intends to do, nor ever can do by any physical possibility. A projectile range of six miles and of sixty miles are equally out of the power of man to accomplish. And, as to the "invisible shell," all the fine-spun stuff about chemical explosive agents only shows the shallow knowledge of the subject possessed by the writer.

The latest destroying invention published is Mr. Nasmyth's (of Manchester) iron steam ship, screw-propelled, bomb proof, and sharp beaked, to run into the unlucky old-fashioned men of war, and crack them like eggs.* This invention, complete in all its details, is only a "réchauffé." The writer distinctly recollects Captain Richard Bourne, R.N., describing the same thing to him most minutely, at least twelve years ago. Captain B. is still living.

R. M.

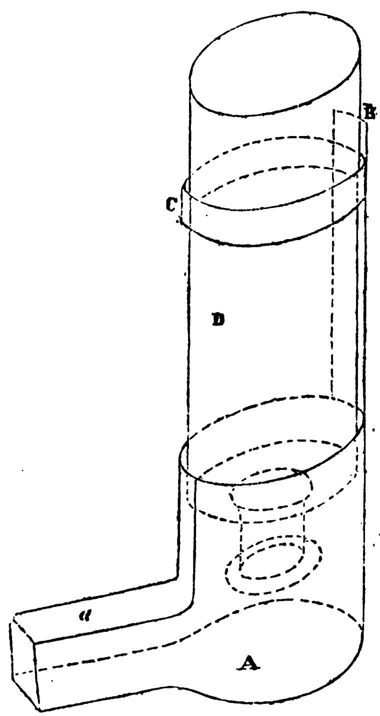
* Capt. Warner Surpassed.—Mr. Nasmyth, the inventor of the steam hammer, has submitted to the consideration of the Lords Commissioners of the Admiralty the plan of an iron steamer, bomb-proof, which will effectually destroy any ship or squadron. She is propelled by the Archimedean screw, and, when going at the rate of six knots an hour, she will run stem on to a ship, and leave a hole in her many feet wide, below the surface. It is, in fact, the power of two ships coming in collision with each other at the rate of ten knots an hour, placed by mechanical means, in the hands of not more than three men. This invention is now under their lordships' consideration, and there can be no doubt but it will put Captain Warner's invention at a discount.—*Daily Papers.*

THE VICTORIA BIRD-CAGE FOUNTAIN AND SEED SUPPLIER.

[Registered under the Act for Protection of Articles of Utility. Mr. C. G. Jarvis, 3, New Church-street, Lisson Grove, London, Proprietor.]

Sir,—The amusements of a friend have lately called my attention to the best mode of supplying caged birds with food and water, and I find there are objections to all the methods in common use. With the glass boxes or metal cups outside the cage, an accidental jerk in moving it, or a little negligence on the part of the attendant, places the bird in danger of famishing; while, with those vessels which are entirely inside of the cage, the water is quickly rendered unfit for use by the bird itself. All these objections are in a great measure obviated by the glass fountain; but on the other hand, it has objectionable qualities peculiar to itself, the chief of which are its high price, its being very liable to get broken, and the difficulty of cleaning it when it gets green and foul inside.

But the objections to the fountain do not apply to a common vial, which is about one-tenth the price, is less liable to breakage on account of having no projecting trough, and is easily cleansed; and it did not require much ingenuity to contrive the "Victoria Fountain and Seed Supplier."



A is a vessel of tin or other metal or substance, part of which forms a trough, *a*, of a convenient size and shape, either to go inside the cage, or fasten outside of it as may be desired. Fixed to this vessel A, is an upright, B, and hoop C, for

holding the vial D, which is supported by a bridge, or otherwise, in such a manner as to keep its open end nearly on a level with the top of the trough *a*. This apparatus constitutes the new fountain, which is held in its place by a ring sliding on the wires of the cage in the usual way.

When the fountain requires replenishing it is taken from the cage as other fountains are, the two parts are separated, the fresh water poured into the vial while its mouth is *upwards*, and the other metal part is *inverted* and put *over* the vial; and then the whole apparatus may be turned into the position in which it is used without spilling a drop of the water.

A vial with a larger mouth than ordinary will be found necessary for the seed supplier.

Now, if economy be the desirable object, the metal part of these vessels may be made of tin, japanned outside, and sold for a mere trifle; and the only breakable part of the fountain will be a penny vial.

On the other hand, it is obvious that these fountains and seed suppliers may easily be formed so as to become tasty and ornamental appendages to the cage. And when I considered the very great number of persons who take delight in caged birds, and to whom the cost of elegant appendages would be a matter of no more consequence or consideration than the cost of the cage itself, I thought the contrivance so valuable that I had it registered; but I do not contemplate either making or selling it myself, and am prepared to transfer the right to do so, either for the whole of the three kingdoms, or any of them, or for any particular district, to such person, or persons as may choose to purchase it; and who can communicate with me by letter,

I am, Sir, your obedient servant,

C. G. JARVIS.

3, New Church-street, Lisson Grove, London.

NECESSITY OF COMBINING VENTILATION WITH WARMING IN FACTORIES, DWELLING-HOUSES, ETC.

[From Observations on the Sanatory Arrangements of Factories. By Robert Ritchie, Esq., C.E., F.R.S.S.A. Read before the Royal Scottish Society of Arts, Session 1844.]

(Concluded from page 208.)

Again, with respect to the mode of withdrawing the vitiated air from rooms, I have also given ample evidence, notwithstanding various opinions to the contrary, and even the Reports of the Prison Inspectors—that the opinion of Dr. A. Ure is correct, namely, "that the downward circulation of air every physiologist will deprecate as a noxious fallacy—the mephitic exhalations from the lungs having a temperature of 98°, occupy the upper part of a room, and if forced downwards by any means, must inevitably be breathed again and again, before their particles can be discharged at the feet in violation of the laws of specific gravity." Where, however, mechanical means are adopted to create a current, the vitiated air may be extracted either at the ceiling or the floor as may be desired; but the ascending movement of the air is unquestionably the natural one, and, therefore, is generally preferable. Having now given the opinion I entertain as to the principle of ventilation and warming which should be applied to occupied apartments where artificial heat is requisite, I shall now proceed to notice a few of the proposals for the improvement of factory-ventilation I submitted to the Society.

I propose to *warm the atmospheric air to a moderate temperature before admission to all factories by mild heating surfaces—to combine the ventilating with the warming process, by giving continual supplies of fresh and pure air in every case with the heat, and regulated in moisture according to the temperature of the air;*—and in factories where high degrees of heat are requisite, such a mode of warming the air may be combined with the surface of pipes, but if possible should be avoided. I propose to make use of mechanical ventilation in factories,* by means of a wind-fan, screw ventilator, or air-pump placed at the bottom of the building, in order to throw in a constant stream of fresh air of regulated warmth, and to draw off the exhaled or vitiated air by a wind-fan on the upper part of the building, communicating with pipes placed near the ceiling of each room, these two wind-fans being worked either by the steam-engine, or other power as may suit best, or that some similar mode be adopted at every factory to

* With respect to mechanical ventilators, such as wind-fans, air-pumps, screws, or what has been strangely termed wind-mill ventilators, it will at once appear obvious to any one, that their value for artificially creating a current, must be when a motive power is in existence at the building to keep them in motion—this must be always the case at factories where steam or water-power drives the machinery;—to erect a steam-engine on purpose to drive the fan as is sometimes done may prove inconvenient; to trust to hand-power, or even the use of weights is uncertain in effect, and recourse in such cases should be to natural ventilation assisted by safe artificial heat.

attain a constant and steady supply and movement of the air throughout the different floors of the factory, and that it may be kept at an equal and regulated temperature and a full supply of pure air may be thrown in.

To apply these principles I have detailed to mills now in operation, heated with steam-pipes, placed over the machinery passing longitudinally through each floor is not unattended with difficulty, but I shall endeavour to show how this may so far be overcome at a moderate expense. The latter is important, for as most innovations, and sometimes not improperly, are met with objections, those who may have already in use the hot-house process of heating,* will not be very likely to adopt another, if attended with any material alterations. What I therefore propose for mills now built can be tried with no great outlay. As a preliminary point, however, I must observe, that a plan of previously moderately warming the air, in a proper manner before admission, necessarily implies the necessity of having a greater surface for radiation and conduction of the heat, than when the surface is exposed in the apartment; but as was long ago remarked by the late Mr. Tredgold, "the additional quantity of pipe and fuel this degree of ventilation requires, cannot be withheld by any person endued with common humanity."

It occurs to me, that supplies of warm air to factories built in floors now in use might be attained, were the steam pipes as presently arranged, where timber floors are used, enclosed in air-flues or conduits, namely, a case of wood,† lath and plaster, or other material of sufficient dimensions to permit an ample supply of pure air to environ them. By having the upper part of the case open, and the sides carried up to the flooring of the room above, (the ceilings are commonly not plastered), and the floor directly over the air-flue perforated with small holes the length of the flue beneath, or iron gratings inserted at such places as the machinery will admit level with the floor, or branch flues made to permit the outlet for the warm air at lateral openings in the skirtings.‡ It will be at once seen, that an inflow of warm air, may be attained over the entire factory, consisting of any number of floors; the warm air entering at the lower level, and the absurdity got rid of, of enveloping the head and upper part of the body in an atmosphere radiating from a surface at 212°, whilst the feet are kept much colder. By the plan I propose, a more equal diffusion of heat will be attained between the upper and lower part of the work-rooms, and constant and abundant supplies of pure air afforded, regulated in temperature and humidity. When circumstances admit, instead of using flues to the environ pipes, when there is sufficient height between floor and floor, false ceilings can be made, in which the steam-pipes passing through the flues may be enclosed, thus forming an air-equalizing chamber under each floor, from which the warm air can be admitted to such parts of the work-rooms as may be convenient to permit as complete a diffusion of it as possible. In other cases, where a double ceiling cannot be adopted, the present steam-pipes in the middle of the rooms might continue, and additional pipes be erected at the side walls, enclosed as before in conduits or air-channels; the warm air from these being admitted laterally by means of a perforated skirting, or wash-board, over the entire length of the room above, and thus similarly arranged over the different floors.

When factories are built with arched floors, or forming fire-proof mills, heated by steam-pipes passing through the mill, it might be attended with inconvenience to place these pipes in suspended flues, from the difficulty of having numerous openings over the pipes. In such mills, however, there is nothing to prevent the vacant spaces at the spring of the arches to be converted into ventiducts, into which the steam-pipes might be laid (this plan has been successfully adopted in other buildings,) to warm the air in its horizontal progress, and thus induce the movement or current onward by the action of the heat, the warmed air being admitted at the floor of each story, as widely diffused as possible, by numerous apertures left in the flooring, as already alluded to. In many cases it will be found preferable to have the apertures formed for the inlet of the warm air laterally, as at the skirting; or where this cannot be done, and the machinery will admit of it, pipes might be placed, as it were in a box or case, running along the basement of the walls, the warmed air entering the room at the side of it; the advantages of lateral apertures are, that it prevents the lodgment of dust in the flues. For the reasons I have already assigned, I prefer placing the warm, or fresh air inlets at the floor of the rooms, and prefer the natural or ascending movement; however, the opposite method might be adopted where found more

* Some persons have written in favour of this principle of heating buildings.

† No danger from fire can arise from steam or hot-water pipes at ordinary pressure.

‡ To avoid the inconvenience arising from the openings for the air being placed in the floor instead of laterally, the floor might be covered with a porous texture: this however might prove inconvenient in factories, but as the ventilating apparatus would be in constant use, there is not much risk of the lodgment of dust, or with a slow movement of the air, any annoyance being sustained.

advantageous in removing the dust of the materials, viz., having recourse to a descending movement of the air, the inflow of air at the ceilings, and the outlets at the floor.

The supply of fresh or external air to these various flues, may enter directly from without through the end walls, dividing the horizontal flues, as it were, into two chambers, the cold air entering the lower portion; and in very long rooms, in order to attain diffusion, the air may be propelled forward by means of a small wind-fan, driven by a belt from the shafting on each floor.

These very simple schemes for affording a supply of warm fresh air in winter into factories, would be rendered much more effectual and complete, if combined with a properly constructed *air-preparing chamber*, at the basement of the building, either at one end or towards the middle of very long rooms, that the air may have less distance to travel from the chamber. I propose that the horizontal flues in the different floors or stories of the mill, be connected with vertical flues which shall terminate in the preparing chamber; and advantage may be taken of the flow and condensed steam-pipes to have them placed within the vertical flues. I recommend that in the preparing chamber, a powerful wind-fan, screw, or air-pump be placed, driven by a power from the engine,* or by a separate steam engine. That in this chamber likewise, a hot water or steam apparatus of the most salubrious description to warm the air be provided, carefully removed from the furnace-room. The chamber shall be so arranged, that the air can be filtered and purified at pleasure, and supplies of moisture imparted to it;† the fresh air being admitted in large volumes, and from the purest source. Everything, indeed, depends on the supply of fresh air; if this is impure, it conveys its impurities over the building; hence, the absurdity of admitting fresh air into buildings, by damp under-ground culverts, or taking the air from the vicinity of drains, or sunk areas. When the air is impregnated with impurities of smoke, as happens often in manufacturing towns, it may be made to pass through a gauze screen, or a shower of pure water; the latter in summer will cool the air pleasantly, though it is desirable not to saturate the air with water *before warming it*. The air having passed through any porous substance to exclude the soot, enters the chamber, where in winter it is moderately warmed, afterwards moistened, and then propelled by means of the injecting fan over the whole building, aided where necessary, by the small fans at the end of the horizontal flues, or between the two ceilings. By simply placing the entire air in the preparing chamber, thus under *one point* of control, and merely shifting a valve, warm or cold air, at any temperature, could be blown into the flues, and diffused over the different rooms; and as the pipes on each floor are provided with throttle valves to shut off, or let on the steam into the pipes, the whole building could be placed under the most perfect control, as to the warming of it.

It is hardly possible, in a building already erected, to make the ventilating arrangements so perfect as could be wished; as any proposal may interfere with some part of the operations carried on. But for the withdrawal of the vitiated air, the most simple plan is to have separate flues, or wood cases, carried up from the ceilings of the respective work-rooms, till they reach the vacant space over the ceiling of the upper or attic floor directly under the roof. The vitiated air may here be collected into one large horizontal conduit or ventiduct, and conveyed to one end, or if more convenient, to the middle of the roof of the building, where a wind-fan, or screw ventilator may be placed,* driven by power taken from the machinery, for the purpose of propelling the impure air into the atmosphere through a tunnel carried up as high as convenient, terminating with an air escape revolving with its back to the wind. The use of the second fan in a building consisting of several floors must be obvious, as, from the many turnings the air has to undergo,† the power of the *impulsive* or forcing fan would be greatly diminished; and although the same quantity of air may be discharged which is forced in, yet unless a separate fan or other means is made use of to create a current at the roof, the same certainty of a steady movement of the air, or perfect ventilation, could not be obtained.

In place of carrying upwards a number of separate flues from each floor to the roof, one large tunnel placed at one end, or at the centre of oblong buildings may be substituted, into which at the ceilings of each room,

* Mr. Oldham's (of London) plan, as used at the Bank of England, has been recommended highly in the *Civil Engineers' Journal*, as suitable for a purpose of this kind. He uses an air-condensing pump, worked by steam power.

† The plan adopted at a flax-mill I have seen does very well; a jet of water is made to fall on a circular iron plate, revolving with great rapidity—(800 revolutions in a minute)—driven by means of a belt from a steam engine; this sends a shower of spray upon the entering volume of fresh air.

* A patent has been taken out in London for the single thread ventilator. It should be kept in view that all revolving screws of this kind, unless in constant motion, obstruct the aperture for inlet or outlet of air.

† It was mentioned by Professor Leslie, that the whole power of a blast furnace could not extinguish a candle when air passed through pipes with many turnings.

the vitiated air may be discharged; the whole ascending to the wind-fan at the roof.* The movement of the air in one large tunnel common to all the floors cannot be so much depended on, as it is liable to the risk of the efflux of the air from it into the upper rooms, unless a very powerful exhausting or *vacuum* movement can at all times be induced.

By limiting the discharge of the vitiated air at the roof to *one point* of sufficient magnitude to suit the building, and having a wind-fan there under complete control, the movement of the air, in combination with the impulsive fan, may be regulated to the most precise degree, and all offensive currents avoided, and the use of open windows dispensed with, excepting in summer, or for the purpose of admitting air when the rooms are not occupied by the workers.

By such a simple scheme as I have now detailed, the whole warming and ventilating arrangements of factories can not only be placed under perfect control, but there can be no doubt of their increased salubrity, and that the atmosphere in them will be very different from the stagnant one loaded with impurities of all kinds, which at present too often exists.

[We are happy to find that Mr. Ritchie has published in a pamphlet (see List of New Publications) the whole of the paper from which we have made the preceding extract. It is by much the most interesting and instructive essay on ventilation and warming which has yet appeared; and differs advantageously from other works on the subject which might be named, in giving almost always its authorities, chapter and verse. The writer is not one of those who have any occasion to conceal from the world how much they can call their own.—Ed. M.M.]

ENGLISH STEAM-BOATS ON THE RHINE.

The crack vessel on the Rhine at the present time is the *Elberfeld*, built by Messrs. Miller and Ravenhill, to replace the iron steamer of the same name which was lost some time since in crossing the North Sea, (see *Mech.Mag.*, vol. xl., p. 147.) From the subjoined extract of a letter from one of the owners it will be seen that she much exceeds in speed every vessel which has yet made its appearance on that station. And considering that the Rhine could previously boast of some of the fastest steamers known to continental waters, this must be allowed to say not a little for English engineering skill. Both boat and engines were constructed by the same eminent London firm; they were left at liberty to construct her in every respect according to the best of their own judgment; and the result is one of which they have certainly every reason to feel proud. The *Elberfeld* is 170 feet long between perpendiculars, by 18 feet wide; and she draws with a full load 2 ft. 10 in. She is propelled by a pair of engines of 40-horses power each. They are *beam* engines; and so far we may be allowed to doubt the soundness of the discretion exercised by the constructors. Such as they are, however, they are perhaps the very lightest of the sort—the beams, frames, and all the moving parts being of wrought iron. The boilers are, like all the best boilers of the present day, tubular. The outward passage of the *Elberfeld* from Blackwall to the Brill was performed in 13 hours 50 minutes; and the voyage thence to Rotterdam in 1 hour 15 minutes.

(*Extract.*)—"This vessel has beaten all we had till now on the Rhine. I went with her on her trial trip from Cologne to Mayence, and being confident that it will interest you, I inclose a list of the hours of departure from, and the arrival at the different places, by which you will observe that she took 13 hours 25 minutes, stoppages included, from Cologne to Mayence. The *Lightning*, from Mr. Cockerill's, the last and fastest vessel of the Cologne Company, occupied on its trial tour for the same distance, 14 hours 8 minutes, stoppages *ex*cluded, which you may, by average, calculate at 17 minutes, so that we beat her 1 hour for the whole distance. And this, though one of the axles became hot, and for the last six hours we had very little steam. Please to observe that the *Lightning* left Cologne 24 minutes before the *Elberfeld*, and that she overtook her at Newied. The *Elberfeld* is a nicely built, fine-shaped vessel: and makes 15 miles an hour against stream."

NEW ATMOSPHERIC STEAMER—THE "WONDER."

Messrs. Seaward and Capel have just completed another steamer on the atmospheric principle, which is to be called the *Wonder*. She is owned by the South Western Steam Navigation Company, and is intended for the Southampton and Havre station. Her length between perpendiculars is 160 feet; breadth of beam, 22; depth of hold, 12 feet 9 in.; draught when light, 5 ft. 6 in., and when loaded, 6 ft. 6. in. Her machinery is similar to that of the well-known fast-goer the *Sapphire*, constructed on the same principle; there are three open-topped cylinders provided with expansion valves, each cylinder being 53 inches in diameter, with 3 ft. 6 in. stroke. The

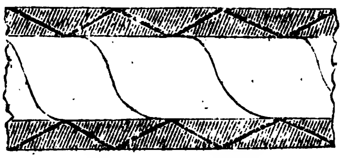
* A very neat arrangement is a cowl or turncap, concealed by louver boarding.

nominal power of the engines is 130 h. p.; but the real power must be nearer 200. The boilers are tubular and two-storied. The paddle-wheels are of the vibrating class, on a plan which is a modification or improvement of Morgan's and Cavé's. Each wheel is 20 feet in diameter, and has 12 floats, with a surface each of 20 square feet.

The *Wonder* made a trial trip down the river yesterday (Friday, 27th); but the results had not reached us at the time of our weekly Number going to press.

NEW FRENCH GUN BARREL.

In the engraving given at page 102 of our present volume, illustrative of Messrs. Renette and Gastine's new mode of manufacturing gun barrels, the lines which complete the *triangular* section of the bars, forming the spirals, were, by oversight, omitted. We insert a more correct figure.



LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65, FROM AUGUST 28, TO SEPTEMBER 24, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
August 28	257	John Harcourt Brown	Stoke's-cottage, Ramsgate	Safety horse-shoe.
,,	258	William Lea	Horsley-fields, Wolverhampton.	Double action mortice bolt.
31	259	Tyler and Pace	London-fields, Hackney	Detector envelope.
Sept. 3	260	Thornhill Warrington	66, Upper Berkley-street, Portman-square	Valves, glazed and unglazed, for ports, &c.
5	261	J. Whitmee	70, Saint John-street, Clerkenwell	Mill for grinding drugs and groceries.
10	262	George Jones	Walsall, Staffordshire	Design for a perforated edge tooth brush with waxed back.
,,	263	Charles Gatliff	Coleman-street, London	Improved ecritoire.
11	264	John Russell	Greenock	Improved sugar vacuum pan.
12	265	Henry Clement	Bath	Chimney guard and ventilator.
13	266	Charl. Godfrey Jarvis	New Church-street, Lisson-grove	Bird-cage fountain and seed supplier.
,,	267	Mark Lumb	Leeds	Improved form of machinery for fulling woollen cloth.
,,	268	W. S. Villiers Sankey	Caroline House, Hampstead	Self-protecting envelope.
14	269	Fred. Benj. Geithner	40, Fleet-street, Birmingham	Metal steady for window frames
16	270	Samuel Messenger and Sons	Birmingham	Design for raising the cotton wick in vesta lamps by a grooved wheel pressing against the cotton.
17	271	William Mason	Great Bourton, near Banbury	Drill for agricultural purposes.
18	272	E. Rose	Ogley, Staffordshire	Expanding scuffle or stubble plough.
19	273	Joseph Taylor	Southampton-street, Pentonville.	Portable apparatus with self-acting friction band; spring or clip for escape from elevated places in cases of fire, &c., and for lowering goods or persons generally.
,,	274	Thomas Robinson	Ripon Iron Works, Ripon	Novel form of clod crusher.
21	275	George Thompson	Woodstock	Design for the formation of a glove.
,,	276	George Kershaw	Wilderness-row, Clerkenwell	Improved leaf and pamphlet holder.
24	277	William Peirce	Giddal's-road, Derby	Peirce's sash-fastener.
,,	278	Webster and Son	Cornhill, London	The orthochronograph, or accurate guide to the time-keeper.

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN SEPTEMBER.

TABLES showing the PROGRESS of the SHIPPING INTEREST of the BRITISH EMPIRE, United States, and France: compiled from Parliamentary Papers and other sources. By George Bayley, Surveyor to Lloyd's Register of British and Foreign Shipping. 4s.

A TREATISE on the PRACTICAL DRAINAGE of LAND, of all DESCRIPTIONS. By Henry Hutchinson, Land-agent, Valuer, and Professor of Draining, Walcot, near Stamford. 10s.

ELEMENTS of AGRICULTURAL CHEMISTRY, in a Course of Lectures Delivered before the Board of Agriculture. By Sir Humphry Davy, Bart. A New Edition, with Instructions for the Analysis of Soils, and Copious notes, embracing the Recent Discoveries in Agricultural Chemistry. By John Shier, A.M., Fordyce Lecturer on Agriculture in the University of Aberdeen. 9s.

SECOND SERIES OF FAMILIAR LETTERS on CHEMISTRY, containing the Philosophical Principles and General Laws of the Science. By Justus Liebig, M.D., Professor of Chemistry in the University of Giessen. Edited, from the *Lancet*, by John Gardner, M.D.

LECTURES to FARMERS on AGRICULTURAL CHEMISTRY. By Alexander Petzholdt.

AN INVESTIGATION of the PRINCIPLES of the Rules for Determining the Measures of the Areas, and Circumferences of Circular Plane Surfaces, and the Capacities and Bulks of Certain Spherical and Cylindrical Vessels and Solids. By the Author of "A New Theory of Gravitation," "A New Introduction to the Mathematics," "A New Treatise on Mechanics," &c. 2s. 6d.

GEOLOGICAL OBSERVATIONS on VOLCANIC ISLANDS. By C. Darwin, Esq., F.R.S. V.P. Geo. Soc. 10s. 6d.

OBSERVATIONS on the SANATORY ARRANGEMENTS of FACTORIES, with Remarks on the Present Methods of Ventilation and Warming, and Proposals for their Improvements. By Robert Ritchie, Esq., F.R.S.S.A., &c., Civil Engineer. 1s. 6d.

GUIDE to the GEOLOGY of SCOTLAND; containing an Account of the Character, Distribution, and more interesting appearances of its Rocks and Minerals. By James Nicol, Author of a Catechism of Geology. With a Coloured Geological Map and ten Plates. 6s.

THE METEOROLOGICAL EPHEMERIS, for 1845. In addition to improved Tables of the State of the Weather, Ruled Pages are given for Registering the Weather, Directions and Force of the Wind, Maximum and Minimum of Thermometer, Height of Barometer, and quantity of Rain on every day, as well as for Monthly Summaries. 2s.

Periodicals.

The London, Edinburgh, and Dublin Philosophical Magazine. No. 161. 2s. 6d.

The Edinburgh New Philosophical Journal. No. 75. 7s. 6d.

The Civil Engineer and Architect's Journal. No. 85. 1s. 6d.

The London Journal (Newton's). No. 153. 2s. 6d.

The Repertory of Patent Inventions. Enlarged Series. No. 23. 3s.

The Glasgow Practical Mechanics' and Engineers' Magazine. Part 36. 8d.

The Artizan. No. XX. 1s.

The Builder. No. 77. 8d.

The Nautical Magazine. No. 20. Enlarged Series. 1s.

Pharmaceutical Journal and Transactions (Bell). 1s.

Annals and Magazine of Natural History, including Zoology, Botany, and Geology. By Sir William Jardine, Bart., P. J. Selby, Esq., Dr. Johnson, &c. No. 139. 2s. 6d.

The Zoologist. No. 21.

The Polytechnic Review. No. 3. By Dr. Sigmond and Dr. Stone.

LIST OF ENGLISH PATENTS GRANTED BETWEEN AUGUST 29, AND SEPTEMBER 26, 1844.

James Pillans Wilson, of Belmont, Vauxhall, gentleman, for improvements in treating fatty and oily matters, and in the manufacture of candles. August 29; six months.

William Brunton, jun., of Poole, near Truro, civil engineer, for improvements in the manufacture of shovels for mining purposes. August 29; six months.

Francois Stanislas de Sussex, of Bethnal Green, chemist, and Alexander Robertson Arrott, of Torrington-square, chemist, for improvements in the recovery of manganese used in making bleaching powder. August 29; six months.

Mark Freeman, of Sutton Common, for improvements in apparatus called ever-pointed pencils. August 29; six months.

Moses Poole, Searle-street, London, gentleman, for improvements in pumps. (Being a communication.) August 29; six months.

James Smith, of Queen's-square, London, civil engineer, and William Gairdner Jolly, of Endrick Bank, Scotland, for certain improvements in the form of tiles for draining, in implements for manufacturing thereof, and in the modes of manufacture. August 29; six months.

Frank Fielder, of Old-street, St. Lukes', for certain improvements in wire-work for the manufacture of paper, and the application thereof to such purposes. (Being a communication.) August 29; six months.

William Newton, of Chancery-lane, civil engineer, for improvements in the means or apparatus for preventing shocks or accidents on railways, or in lessening the dangerous effects arising therefrom. (Being a communication.) August 29; six months.

Pryce Birckley Williams, of Llegodig, North Wales, for certain improvements in the manufacture of artificial stone. August 29; six months.

Jean Albert Palmaert, of Brussels, in the kingdom of Belgium, colonel of staff, for improvements in the means of economizing and applying heat obtained from known processes. (Being a communication.) August 29; six months.

Hipolyte Auguste Richard, of Skinner's-place, Sise-lane, gentleman, for a certain improved apparatus for heating and lighting. September 5; six months.

Robert William Sievier, of Henrietta-street, Cavendish-square, gentleman, for certain improvements in looms for weaving, and in the mode or method of producing plain or figured goods or fabrics. September 5; six months.

James Pillans Wilson, of Belmont, Vauxhall, gentleman, for improvements in treating fatty and oily matters, and in the manufacture of candles. September 9; six months.

George Bucknall Picken, of Crosby-row, Walworth, linen-draper, for improvements in umbrellas and parasols. September 12; six months.

Martin Cawood, of Leeds, iron-founder, and William Pritchard the elder, of Burley near Leeds, for improvements in power looms. September 12; six months.

John Chanter, of London, civil engineer, and George Lodge, of Leeds, engineer, for improvements in furnaces, fire-bars, hot air generators, and flues. September 12; six months.

Alfred Simpson, of Farnham-place, Gravel-lane, Southwark, hat manufacturer, for improvements in the manufacture of hats. September 12; six months.

Charles Wearg Clark, of Westbourne-grove, Paddington, surveyor, and James Reed, of Hamworthy, Dorsetshire, brick and tile maker, for improvements in the manufacture of bricks and tiles for chimneys and flues, and for other uses. September 12; six months.

James Power, of Threadneedle-street, London,

merchant, for improvements in the manufacture of candles and soap, and in treating a certain vegetable matter for such manufactures, and for other uses. September 12; six months.

William Newton, of Chancery-lane, civil engineer, for certain improvements in treating and preparing oil or fatty matters. (Being a communication.) September 12; six months.

James Vibart, of Chilliswood House, near Taunton, Somerset, lieutenant in the royal navy, for certain improvements in the means of obtaining and applying power for working or driving thrashing machines, mills, chaff-cutters, and other machines or apparatus. September 12; six months.

Henry Cooper, of Royton, Lancaster, cotton manufacturer, for certain improvements in machinery or apparatus to be used for doubling cotton, worsted, and other fibrous materials. September 12; six months.

Elias Robison Handcock, of Rathmoyle house, Ireland, for certain improvements in mechanism applicable to a method of propelling vessels on the water. September 12; six months.

Webster Flockton, of the Spa-road, Bermondsey, turpentine distiller, for certain improvements in machinery or apparatus for sweeping or cleansing streets, roads, or ways. September 12; six months.

Robert Ferguson and John Clark, of Glasgow, for an improvement in printing and calendering. September 14; six months.

Christopher Vaux, of Frederick-street, Gray's-inn-road, gentleman, for improvements in apparatus for bathing. September 19; six months.

William Birkmyre, of Mill-brook, chemist, for certain improvements in the manufacture of potash and soda, alums, sulphuric acid, and sulphate of soda. September 19; six months.

James Francis Pinel, of Skinner's-place, Sise-lane, chemist, for certain improvements in the modes of treating farinaceous substances. September 19; six months.

Michael Fitch, of Chelmsford, gentleman, for an improved substance for preventing decomposition in provisions, and for the method of manufacturing the same, and of condensing and applying a certain gas or fume to certain perishable articles. September 19; six months.

Antoine Vieyres, of Pall-mall, watchmaker, for improvements in the manufacture of cut-nails. September 19; six months.

William Newton, of Chancery-lane, civil engineer, for improvements in machinery to be employed in the manufacturing of nails, rivets, screws, and pins. (Being a communication.) September 19; six months.

Edwin Edward Cassell, of Millwall, Poplar, merchant, for a material or combination of materials suitable for paving, piping, roofing, and most other purposes for which wood and iron are applicable. September 26; six months.

James Malam, of Huntingdon, gas engineer, for certain improvements in purifying coal gas, and increasing its illuminating power, and preventing the circulation of it being impeded by frost. September 26; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM 22ND AUGUST TO 22ND SEPTEMBER, 1844.

Joseph Martin Kronheim, of Castle-street, Holborn, London, engraver, improvements in stereotyping. (Being a communication from abroad.) Sealed, September 3.

Robert Ferguson and John Clerk, both of Glasgow, Lanark, an improvement in printing and calendering. September 4.

James Pillans Wilson, of Belmont, Vauxhall, Surrey, gentleman, improvements in treating fatty and oily matters, and in the manufacture of candles. September 4.

Francois Stanislas de Sussex, of Bethnal Green, Middlesex, chemist, and Alexander Robertson Arrott, of Torrington-square, chemist, improvements in the recovery of manganese, used in making bleaching powder. September 4.

James Smith, late of Deanston, now of Queen's-square, London, civil engineer, and William Gairdner Jolly, residing at Endrick Bank, parish of Drymen, and of Stirling, Scotland, certain improvements in the form of tiles for draining, in implements for manufacturing thereof, and in the modes of manufacture. September 4.

John Lionel Hood, of Old Broad-street, London, gentleman, an improved composition, or mixture of metals, applicable to the manufacture of sheathing for ships and other vessels, bolts, nails, or other fastenings. (Being a communication from abroad.) September 9.

Peter Ward, of Oldbury, Salop and Worcester, late of West Bromwich, Stafford, practical chemist, an improvement in combining matters for washing and cleansing. September 12.

Edwin Sheppard, of Manchester, Lancaster, builder, certain improvements in machinery, or apparatus for planing, sawing, and cutting wood, and other substances. September 13.

John Beare, of St. John's Wood, Middlesex, civil engineer, certain improvements in engines or machines for raising or conveying water and other fluids. September 18.

James Petrie, of Rochdale, Lancaster, engineer. certain improvements in steam-engines. September 19.

William Newton, of Chancery-lane, Middlesex, civil engineer, certain improvements in treating and preparing oil or fatty matters. (Being a communication from abroad.) September 20.

NOTES AND NOTICES.

Solution of Silk.—A simple piece of worn-out silk is in ordinary usage worth nothing, whilst the same in cotton, linen, or cloth, has for a considerable time been made available for various purposes. Through the researches of Professor Debzenne, the most useless portions of silk can now be transformed into new silk again, to serve for different articles. In the same way that caoutchouc is drawn out into filaments, and woven into a durable material, so are these remnants of silk reduced to what is no more than its primitive state—viz., a glutinous paste, by means of a solvent, and, like fused glass, re-acquires, on coming into the air, all its original strength and tenacity. The crude silk, and that which is not dyed, is easily managed. The inventor at present has found it difficult however to recover the dyed portions of silk, and more especially the black ones, but he hopes by continuing his close attention to the subject to overcome this difficulty, and to relieve France from the duty of 70,000,000 fr. which she pays to foreigners for the means of alimenting her numerous silk establishments.—*Quotidienne.*

Artificial Production of Black Lead.—On demolishing the interior brickwork of the iron furnaces at Niderbronn (Lower Rhine), while the furnaces were still hot, a shower of sparks, or of charcoal dust, had sometimes been observed to escape from the crevices; on examining whence the sparks proceeded, they were found to come from deposits of carbon amongst the stones of the fabric. This carbon appears to have entered the finest fissures in a state of vapour, and to have been deposited either in amorphous fragments, or in balls, the centres of which were amorphous, while the outer parts were radiated, and the surface covered with staligmitic tubercules. This matter has all the properties of plumbago; it burns completely away, leaving only a trace of oxide of iron. It must have arrived at its position in a gaseous state; and appears to explain the origin and formation of plumbago, which would hence seem to be nothing more than carbon sublimed from deposits of anthracite by heat, arising from the proximity of igneous rocks.

Welsh Pearls.—The River Conway in Wales, has long been celebrated for its pearls, which are even enumerated among the temptations which induced the Roman invasion of our island. Large pearls are occasionally found in the *Unio margaritifera* of the fresh-water portion of the river, and small seed pearls are obtained in considerable quantities from the edible mussel (*Mytilus edulis*), of which there are large beds at the mouth of the estuary. The use to which these small pearls are applied, and the channel through which they are disposed of in London, have hitherto remained a secret; and the secret has conferred a monopoly of the traffic on parties who purchase them of the peasantry by the ounce, at such a price as renders the work of collecting them a source of remunerative labour, not only to women and children, but to men. The mussels, when collected, are boiled in large caldrons, to cause the opening of the shells; and, the mass being stirred and washed, the pearls are found at the bottom of the vessel.—*Mining Journal.*

American Railways.—An extraordinary performance, equal to the greatest railway achievements of Great Britain, is recorded in the American papers. The Government express, which left Boston for New York with letters, mails, and passengers, on the arrival of the *Acadia* from England, on the 18th ult., were conveyed the distance of 238 miles in six hours, by railway!

How to Chlorify Mephitic and Noxious Atmospheres.—Take a large dry sponge, squeeze it closely together, and thus allow it to expand in an atmosphere of chlorine; after which, transfer it to an air-tight bag, closed like a purse-mouth. When required, the bag is to be opened, and a gentle pressure employed to disengage the chlorine from the sponge.—*Professor Murray.*

Paddle Floats.—Two iron steamers, for the Ardrossan and Fleetwood station, have been constructed by Messrs. Tod and M'Gregor, of Glasgow; they are 600 tons burden, with engines of 300-horse power, the chief feature being that the paddle floats of one are solid, and the other divided. A trial was made to test their capabilities, and the result was that the solid float was declared in point of speed to be superior to the divided one. —*Glasgow Papers.*

Telescope Extraordinary.—M. Lerebours, the optician, has made a telescope 38 centimetres in diameter, with which M. Arago has been able to make observations which he had been unable to make with any other instrument. This telescope, by reason of its dimensions, and the great number of luminous rays which it receives, requires a certain state of atmosphere, in order for the objects to be very clearly defined; but under favourable circumstances the rings of Saturn are seen with admirable distinctness through this glass, and the mountains of the moon are defined with great distinctness.

Screw Propelling.—A new line of iron steamboats with Ericsson's propellers, has been established in Philadelphia by G. W. Aspinwall, Esq., to carry freight and passengers to New York by sea. The first trip was made by the *Ashland*, with 2,000 barrels and 25 passengers. A similar boat for this line, called the *Henry Clay*, is nearly finished.—*New York Herald.*

English Silk.—Mrs. Whitby, of Newlands, near Lymington, Hampshire, has forwarded to the Royal Agricultural Society, a specimen of silk, grown and wound off at her residence. In the communication accompanying the silk, she states that she has for some years been a cultivator of the mulberry and the rearer of silk worms; having, so early as 1835, formed the opinion that silk might be produced in England with great advantage. She considers that the mulberry tree is frequently exposed to as severe cold in winter, in the neighbourhood of Milan, as it is in England; and her own experiments have since shown, that it will live very well through an English winter. She states that the hatching of the eggs is carried on in a room heated to the temperature of about 70 degrees, by an Arnott stove; and she finds it better to have the process of hatching begun about a month later than is usually begun in France and Italy. Mrs. Whitby adds:—"The expense of an establishment such as mine, would be small; that which I have incurred in my unassisted efforts to succeed must not be considered as necessary by any one willing to take advantage of my experience; and I am so desirous to see the culture of silk become general, that it will give me much pleasure to answer any inquiries you may wish to make, or give any information in my power. I almost fear I shall have tired you with this recital; but I knew not how to make it shorter, so as to be clear and convincing. Be it remembered, that there was the same prejudice in France as now exists in England against this branch of agriculture; it was attempted to be overcome by Henry IV., but what he tried to force by edict, became general as it became better known. All I desire is, to make it known, that others may try in other parts of England."

Poisoning by Arsenic.—M. Grimaud, a chemist, at Poictiers, has proposed a mode of rendering poisoning by arsenic more difficult. He recommends that this article shall be sold only when mixed with a certain quantity of sulphate of iron and cyanure of potash. About one per cent. of each substance would, he alleges, be sufficient. The arsenic, thus qualified, shows itself either by colour or smell, when used in the various aliments fit for man. Thus, arsenic prepared this way, and thrown into warm meat soup, gives immediately a green bronze colour; into hot milk, an opal; into red wine, a violet; into bread, a deep blue; and so on for 20 mixtures, on which M. Grimaud has made experiments.—*Galignani's Messenger.*

Growing Potatoes by Galvanism.—On the 2nd July, Mr. Wm. Ross presented to the New York Farmer's Club, some potatoes measuring seven inches in circumference. He planted the seed potatoes in drills on the 6th May last, using only leaves for manure. Across three rows at one end he buried a sheet of copper, 5 feet long and 14 inches wide, and at the other end, 200 feet distant, a sheet of zink of like dimensions. The sheets were placed in an upright position, and were connected by a copper wire, thus making a galvanic battery, the moisture of the earth completing the circuit. On the 15th, some potatoes were taken from these rows, varying from one inch to one inch and a quarter in diameter. On the 2nd July, others were dug that measured 2½ in diameter. Some of the adjoining rows, beyond the battery, were tried, but few of them had potatoes larger than marrowfat peas—certainly none larger than a boy's marble. Mr. Ross had made other experiments with electricity from a common Leyden Jar, and by applying the charges three times, he succeeded in producing cucumbers in the open ground, which measured five inches in length in 37 days from the time of planting the seed.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1104.] SATURDAY, OCTOBER 5, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

WHARTON'S PATENT IMPROVEMENTS IN STEAM ENGINES.

Fig. 1.

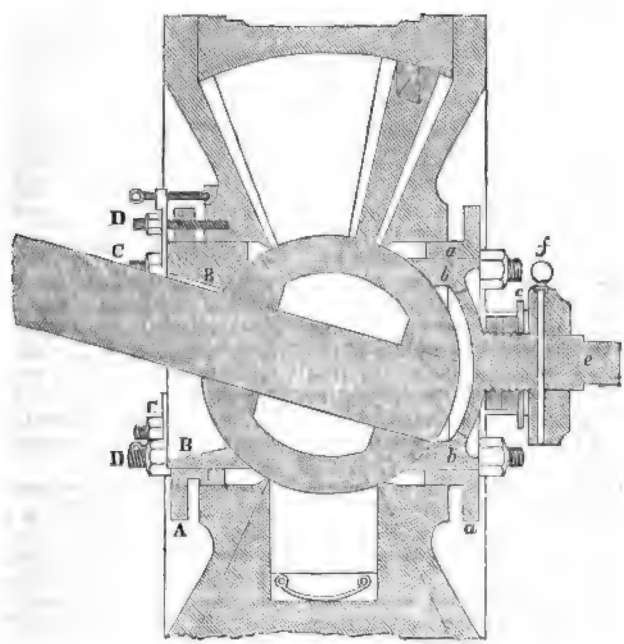
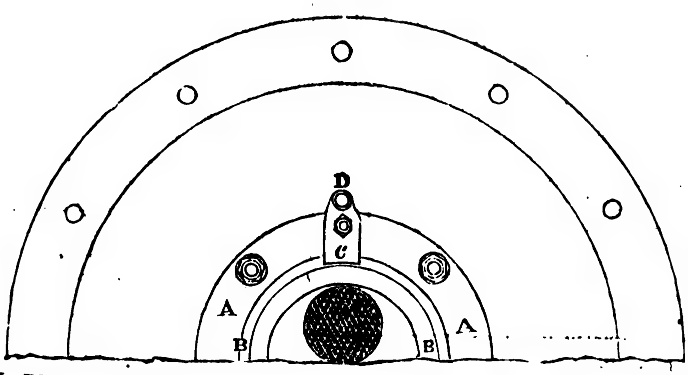


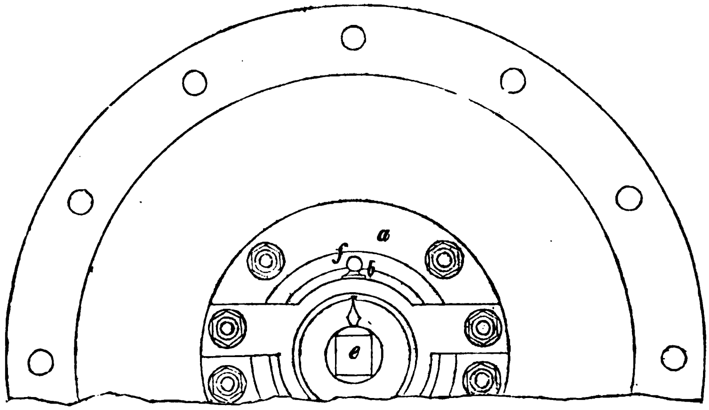
Fig. 2.



WHARTON'S PATENT IMPROVEMENTS IN STEAM ENGINES.

[Patent dated March 14, 1844; Patentee, Emanuel Wharton, of Birmingham, Engineer. Specification enrolled September 14, 1844.]

Fig. 3.



The most interesting of the improvements which form the subject of this patent, is a mode of metallic packing, adapted to that well-known class of engines known by the name of the Disc Engines, and by which the objections hitherto made to them on account of their liability to leakage, are expected to be completely obviated.

Fig. 1 of the accompanying engravings is a transverse section of the entire engine; fig. 2 an elevation of the front cone, and fig. 3 an elevation of the back cone.

A, fig. 2, is a gland bolted on the cone, in which gland is fitted the metallic ring, B, with a small portion of hemp interposed between, for the purpose of preventing any leakage of steam round the periphery. B is the metallic ring which serves as the front packing to the ball of the disc. C C C are three springs, bolted to the cone above the gland A, which press at their points on the three projecting parts, *p p p*, of the ring B, and are intended to keep the ring up to the ball, but so as to allow of a little play; D D D are set screws for tightening or loosening the springs as required. In fig. 3, which represents the back cone, and in fig. 1, where the same parts are seen in section, *a* is a gland, similar to A, which is bolted on the back of the cone, in which gland is fitted the metallic ring, with a small portion of hemp interposed as before; *b* is the internal metallic ring or back packing to the ball of the disc, which is of the same form as the front internal ring B; *c*, a strong steel spring for keeping the ring *b* up to the ball; *d d*, a pair of lock nuts for tightening the spring *c*; *e*, a square fixed on the projecting shaft of the metallic ring *b*, for the purpose of receiving a key, by which the ring may once a-day be turned in part, or half round, so that the wear may be equal, and the disc be more certainly kept in the centre of the cylinder; and *f*, a pin for locking the metallic ring *b*, when the engine is in action. Instead of turning the ring in part, or half round daily, to secure the wearing of it equally, the same object may be effected by applying a slow revolving motion to the shaft of the ring, in which case the locking pin would of course have to be dispensed with.

Mr. Wharton's specification contains also the following description of a plan of metallic packing applicable to steam-engine pistons generally. The peculiar feature of it is that, though the usual steel springs are dispensed with, it can be readily adjusted from time to time, to any degree of tightness desired.

Fig. 4 is an elevation of the body part of this piston. Fig. 5, a section of the same on the line *a b*, and fig. 6, a plan on the line *c d*, of fig. 5. A and B are the top and bottom plates of the body of the piston, and C the boss for the piston-rod. A^2 A^2 A^2 A^2, are four equal segments, forming, together with the wedges G G G G, inserted between them, one circular

ring, which fits into the exterior of the space between A and B; these segments are, on their inner faces, of a bevel or conical form, as shown at D D, figs. 4

Fig. 4.

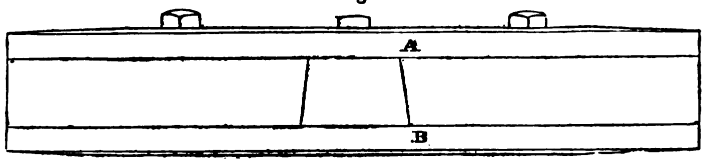


Fig. 5.

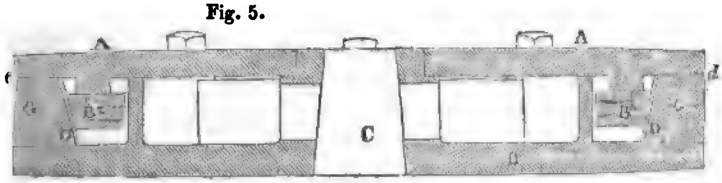
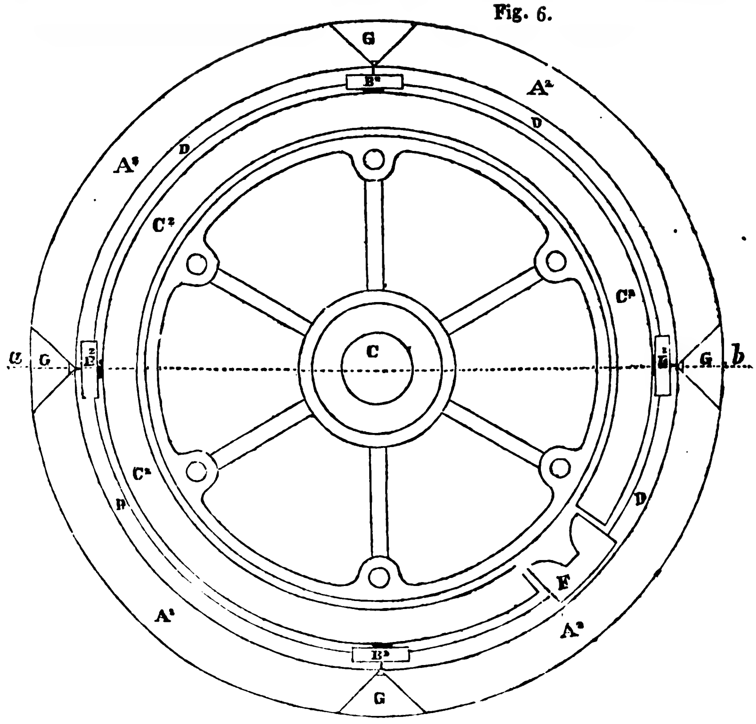


Fig. 6.



and 5. C^2 is a ring of cast-iron or steel, dropped into the space between the external ring A^2 G, and the raised part of the bottom plate B, which ring, when of

cast-iron, is cut through at one part, so as to allow it to be expanded or contracted. B^2 B^2 B^2 B^2 are four adjusting screw-blocks, the shanks of which are screwed into the expanding ring C^2, and the heads are of such a bevel or conical form as to fit the bevel or conical faces, D, of the segments A^2. F is a stop inserted between the two ends of the expanding ring C^2, to keep it in its proper place. When the top plate, A, is fixed in its place, the perpendicular pressure of the junk ring E, on the top of the ring C^2, and the heads of the blocks B^2, causes these in their turn to press outwards the segments A^2, and keep them firm down on the bottom plate, while the wedges G G, which are bevelled inwards in the direction of their length, as shown in fig. 5, serve to keep the segments flush with the top and bottom plates A and B. When the outsides of any of the segments become worn away, the defect can be immediately remedied by screwing the corresponding block or blocks a little more outwards; and so on, time after time, till the segments are almost wholly worn out. The inner faces of the segments or rings need not be bevelled as shown throughout their whole extent, but at those parts only where the heads of the adjusting blocks abut against them.

The same system of metallic packing which has been last described as suitable for steam-engine pistons, will be found also applicable to the pistons of air and gas engines, and may also be readily adapted to the plungers or buckets of pumps and other machines for raising and impelling fluids.

THE ROYAL EXCHANGE LIGHTNING CONDUCTOR—INSULATION AND NON-INSULATION.

Sir,—I had hoped that your readers might have escaped the infliction of a disputation upon lightning conductors, and that your pages, which are wont to be more profitably occupied, might have been spared for better things. I regret that your correspondent, Mr. Baddeley, should appear again reiterating his former opinions, and endeavouring to raise fresh doubts in the minds of those who read his observations; and I think, Mr. Editor, he pays to yourself a very poor compliment in coming thus a second time *unprepared* into the field, making your columns the vehicle for his *inconsiderate* observations. It would have been but common courtesy to yourself, if he had referred to the pages of philosophy, or made himself acquainted with the results to which experience and scientific research have led; in which case he would have saved himself much trouble, and your readers much needless alarm.

As the idea of *insulating* a lightning conductor is utterly foreign to all our notions of what is right, and never enters the minds of those who are well acquainted with the subject, I did not think in my last of troubling you with any confutation; but as the same opinion is again put forth by Mr. Baddeley, and is still further enforced by the assertion that it is among the "precautions heretofore generally supposed to be essential to safety," I feel it a duty to your readers to put them in possession of the precautions which have, by our soundest philosophers, been pronounced the true essentials to safety; I shall give you the very words of the respective authors, and leave you to judge whether your correspondent or myself has deviated from the "beaten track," as he pleases to term "insulation."

I must premise that, in electrical language, *insulation* means the placing of some non-conducting body, as glass, resin, lac, &c., between the conductor and the building, with a view of preventing the passage of any electricity from the former to the latter. Mr. Murray's conductor, which Mr. Baddeley seems so much to admire, "is attached to the wall by iron clamps, interposing a fold of india rubber between them;" this india rubber is intended as an insulating body; and should it be wanting at any one of the clamps, the conductor would be said to be uninsulated.

Assuming that your correspondent's position were sound, and that *insulation* is essential, does he really believe that a fold of india rubber would insulate a lightning flash? If twenty, thirty, forty, fifty, perhaps several hundred feet of air were not sufficient to *insulate* the flash, and prevent its passing from the cloud to the earth, does he think that the best of our artificial means of insu-

lation would prevent its passing away from the conductor to the building, *if any cause were present to induce it thus to deviate?* If he does believe this, he is most assuredly "not *very* deeply versed in electrical science."

Now it so happens that, in the great majority of edifices, there are causes present which might induce the flash to deviate from the path traced out for it; namely, the presence of large masses of metal, as the clock, for instance, and bells of the Royal Exchange. Our only fear, in such a case, is, that the conductor, which is in perfect metallic communication with the subsoil, and the large vicinal *metallic masses* to which I have alluded, and which are in imperfect electrical connexion with the earth, may *conjointly* present a path offering less resistance to the passage of the flash than would be presented by the *conductor alone.* In this case the flash would divide between the two paths; a portion of it would *leave* the conductor, and enter this metallic mass; for, to use the words of Mr. Harris, the lightning "feels its way, as it were, *in advance*, and absolutely marks out the course it is *about to take*, an inductive action being impressed upon such bodies as happen to lie in the *line or lines of least resistance.*" Your correspondent is aware of the possibility of this distribution of the discharge; for his be-lauded *insulation* is for the sole purpose of preventing it. But, had he been at the pains to consult some of the works I named in my last, he would have found that the "beaten path" which the best electricians have tracked out for averting this source of danger, is precisely the *converse* to his; he would have seen that the "precautions heretofore supposed essential to safety," are the placing—not, as he imagines, an *insulating* medium—but actually a *good and efficient conducting body* between the conductor and the metallic mass. The following extracts were collated in my last memoir on lightning conductors:—

(*x*) "I have no fear of lateral discharge from a WELL-ARRANGED conductor. As far as I understand lateral discharge, it is always a discharge *from the conductor itself;* it might be very serious from a badly-arranged conductor, (and in fact makes them worse than nothing,) but, with a good lightning rod, it can be but small, and then not to badly conducting matter, as wood and stone, but only to *neighbouring masses of good conducting matter, as the metals*, which either ought not to be there, or if they are necessarily present, ought to be in *metallic communication* with the lightning conductor itself. I am not aware that lateral discharge can take place WITHIN a building when a lightning conductor outside is struck, except there be *portions of metal, as bell-wires, or bolts, &c.*, which may form an uninterrupted conducting train from the conductor to the interior."—FARADAY.

(*a'*) "The *remedy* in the case of lightning-protectors; namely, *tying together* with a *metallic* connexion all *contiguous readily conducting* bodies."—*Lit. Gaz.* April 23, 1842. *Report of* Dr. Faraday's *Lecture.*

(*b'*) "That there should be neither *large nor prominent bodies of metal* upon the top of the building proposed to be secured, but such as are *connected with the conductor* by some proper *metallic* communication, has been clearly shown by that knowing electrician, Dr. Ingenhousz, in an excellent paper which he presented to the Emperor, containing his opinion of the best method of securing gunpowder magazines against damage by lightning."—VISCOUNT MAHON, vide *Principles of Elect.* p. 218, § 538.

(*c'*) "The only useful remark that can be drawn from this accident [to the Board-house] is, that *all the metallic parts* that are in a building should be *connected with the conductor*, otherwise it is not unlikely, but that either by a *direct stroke*, or by a *lateral explosion*, the house may suffer some *damage* from lightning."—CAVALLO, ELECTR. vol. ii. Ap. p. 210.

(*d'*) "When the conductor of a house is struck, the only *damage* it can receive in that case, it seems, can only arise from a *lateral explosion* between the conductor and *other pieces of metal*, or other *very good conductors*, which are contained in the house, and are not *properly connected* with the conductor. For this reason it is proper to *connect* with the conductor, by a *metallic* communication, all the *pieces of metal*, and, indeed, other *good conductors*, as a *cistern of water*, &c., that are in the house, especially those which are near the *outside* and the *top* of it."—CAVALLO, p. 217.

(*e'*) "All the *metallic parts* of the roof should be *connected with the rod*," &c.—SINGER, *Elect.* p. 225.

(*f'*) "La décharge électrique choisissant toujours les meilleurs conducteurs, et suivant par conséquent les *barres métalliques* du paratonnerre, *plutôt* que tout *autre corps*

voisin."—BIOT, *Précis Élément.* vol. i. p. 587.

(*g′*) "We doubt the *propriety of connecting* any of the *metallic* appendages of the roof to such *conductors*, . . . such would be *superfluous*, and might *distract* the lightning in its progress."—MURRAY, *Atmos. Electricity*, p. 123.

(*h′*) "*Every piece of metal* on the roof should have a metallic connexion with *the conductor;* and continuous *strips of lead* should be built into every wall, and *connected to one another* by horizontal strips *communicating* with the conductor." — ENCYCL. BRIT. article *Electricity*, vol. viii. p. 647.

(*i′*) "Quand on pose un paratonnerre, il faut *avoir l'attention de faire communiquer avec le conducteur*, les pièces de *métal* un *peu considérables* qui se trouvent dans le batiment, telles que *les lames de plomb* recouvrant le faîtage, *les arêtes* du toit et *les gouttières en métal.* Il est d'autant *plus important* d'établir cette *communication*, qu'il pourrait se faire que *la foudre se portât avec fracas du paratonnerre sur quelques-unes des parties métalliques.*"—BECQUEREL, vol. iv. p. 144, § 792.

(*k′*) "Si le batiment, que l'on arme d'un paratonnerre, renferme des pièces *métalliques* un peu considérables, comme des *lames de plomb*, qui recouvrent le faîtage et les arêtes du toit, des *gouttières en métal*, de longues *barres de fer* pour assurer la solidité de quelques parties du batiment, il sera *nécessaire* de la faire *toutes communiquer* avec le *conducteur* du paratonnere."—GAY LUSSAC.

(*l′*) "When a building is provided with several rods, each of these should be continued quite to the ground; at the level of the parapet, the several rods should be connected together laterally by slender iron bars; and the *plates of iron*, which enter into the construction of roofs, should in like manner have a *metallic communication* with each other."—PEN. CYC. article *Thunder-rods*, vol. xxiv. p. 415.

In this list there are but two dissentient voices; the rest not merely pronounce in favour of *uninsulation*, but they urge it as one of the essentials to safety. I take from my library any author of eminence likely to treat on the subject. The first I open is Arago; he says,

"Il sera toujours avantageux d'étendre le même genre de *communication* aux *grosses pièces métalliques*, qui fonte partie des toits ou balustrades des édifices, et surtout aux combles *en fer*, dont l'usage commence à devenir si commun."—*Annuaire* for 1838, p. 590.

Brande writes,

"Where a church spire is to be protected, all clamps and bars of *metal* of any magnitude used in its construction, should have a *metallic connexion*, by a strip of lead or otherwise, with the nearest part of the *conducting-rod.*"—*Manual of Chemistry*, p. 274.

Lardner, alluding to conductors, says,

"Their efficiency will be still more augmented if they communicate with each other, and with all the *metallic parts* of the roof."—CAB. CYC. *Electricity*, vol. ii. § 194.

Harris, whose researches on this subject are well-known, says,

"The conduetor should involve in its course the principal *detached masses of metal* in the building."—*Nature of Thunder-storms*, p. 123.

And so I might go on; and, with scarcely any exceptions, I should find the general opinion to be that *uninsulation* is the very essence of what Faraday terms a *well-arranged* conductor. Your correspondent will, therefore, excuse my preferring my position as one of so goodly a host—will excuse my *being* convinced that I have been treading *the* "beaten path"—especially when he sees in it the foot-prints of such men as Faraday, Harris, Brande, Singer, Becquérel, Gay Lussac, and the rest.

And, if it be essential, Mr. Editor, that well-arranged lightning-conductors should be thus uninsulated, does it not occur to you that, when your correspondent, Mr. Baddeley, is "consulted," and he "lays great stress upon the advantages of perfect *insulation* from the building," and gives "directions for the purpose calculated fully to effect that object," he is deviating from the beaten path, and giving directions for the construction of an *ill*-arranged conductor? And think you not that the "*fifty*" conductors of Mr. Murray, whose plan he so much admires, through this very insulation, *may be* deficient in one important essential? So that, if it should chance that any considerable masses of metal are so circumstanced in respect to their contiguity to one of these conductors, as that they should make with it a *conjoint fork*, opposing less resistance than that of the conductor *alone*, it would appear that they are less likely to protect the building than to bring danger to it,

It is not enough, be it remembered, that such a conductor should have "stood the test of *twenty* years;" for, on the same principle, the steeple of St. Martin's church might be said to have stood the test of several twenties of years. It must, at least, have stood the test of having been *struck by lightning*.

But, as I am not so much called upon to expose the imperfection of Mr. Baddeley's conductors, as to show that the conductor of the Royal Exchange is erected on sound principles, it may be instructive if I give you, from Mr. Harris's list, alluded to in my last, a few cases in which the *uninsulated* lightning conductors were violently struck, and carried away their charge safely. You are aware that Mr. Harris's conductors are made, to use his own words, "by incorporating with the masts continuous plates of copper, *connecting* these with all the principal *metallic bodies* employed in the construction of the hull." This, then is an extreme case of absence of insulation; and let us see how these conductors act when *actually struck by lightning*:—

Actæon, 26.

"This ship, during the years 1840 and 1841, was repeatedly exposed to lightning storms in tropical and southern latitudes. The following is a very important and clear account of the phenomena of a burst of lightning and thunder on the masts of this vessel, and the protecting effect of the conductor, as given by Lieut. Bonham, then officer of the watch.

"'When off the coast of Central America, in H.M.S. *Actæon*, on the morning of the 23rd July, 1841, I, being officer of the middle watch, having heavy squalls of rain, thunder, and lightning, had shortened sail, and was running with square yards, wind to the eastward, sky very dark. Whilst standing on the larboard side of the quarter deck, between the main-mast and binnacle, and looking towards the main-top, a most tremendous clap of thunder burst over our mast-heads, the lightning appearing at the same time to run down the conductor. There was no interval of time, that I perceived, between the flash and the report of the thunder, I saw nothing for several minutes after; the quartermaster of the watch, Henry Love, also observed it, and said to me afterwards, it was the sharpest lightning he had ever seen, and was surprised that we were neither of us injured by it. I believe the conductor saved the mast, and probably some men's lives.

"'(Signed,) C. W. BONHAM, late of H.M.S. *Actæon*.'

"*Dryad*, 44.

"Capt. Turner, R.N., late of the *Dryad*, states in evidence,

"'That in a tornado on the coast of Africa, both the foremast and mizen-mast were struck by lightning; the ship appeared enveloped in flames; the thunder was very loud, and instantly succeeded the lightning.' He further states, 'that whilst standing on the quarter-deck, during one of the flashes, I distinctly saw the lightning run down the conductor on the foremast, and the officer on the forecastle came and told me, he heard a hissing noise, resembling the boiling of water; all the men heard it also. A short time afterwards, several of the officers standing abaft, saw it, at the time of another flash, go down the mizen-mast, and heard the same hissing noise.'

"*Scylla*, 18.

"This sloop was struck by lightning in the West Indies, August 6th, 1843, at 7,50 A.M. The lightning fell on the mast, and it appears by the log, was most effectually carried off, without any damage to the spars or hull. Capt. Sharpe, who commands the *Scylla*, thus describes the circumstance:—

"'On the morning of the 6th August, 1843, lat. 24° 3′ north, long. 69° 12′ west, the *Scylla*, at about 8 A.M., was struck by lightning, attended with a heavy clap of thunder, which shook the ship to her kelson. The greater part of the morning watch had been one continued and heavy rain, the weather threatening and unsettled, sky overcast with dark clouds, wind unsteady, heavy thunder and lightning, both sheet and forked, and frequent explosions very close to us.'

"'The ship was struck from a cloud densely charged with electric fluid, which overhung the masts; it was raining furiously all the time.

"'The course of the lightning was from the main-truck down the main-mast, escaping through the ship by the various conductors connected with the mast for that purpose.' Capt. Sharpe further observes, 'there can be little doubt that our spars were saved by the conductors, and from their being fixed, I consider them preferable to any I have ever seen.'"

It is not, however, my intention to leave your readers with the impression that Mr. Baddeley's conductors will not protect a building: insulated conductors *may* be efficient; uninsulated conductors *will* be efficient. If there are no considerable masses of metal near the course of the conductor, there will be no danger

of any division of the flash, and the conductor may be safely insulated—no *harm* will follow its being insulated; in like manner, no *good* will be obtained. It owes its efficiency, not to its being insulated, but to its not being near to any distracting masses of metal; and whether it be insulated, or whether it be not, is all one.

I cannot censure your correspondent for being ignorant of these things; we cannot be wise on all matters: he thought at the outset that he might be mistaken "as to the necessity for, and advantages of *insulation*;" I trust he will now feel that he is mistaken, and will see that there are no advantages in insulation, but some certain disadvantages.

With respect to the "freedom of discussion," which he talks of my crying down, this is not the point at issue. Let him discuss to his heart's content; but let him, at the same time, obtain some acquaintance with the subject on which he discusses; and not, as in the present case, select a science of which he professes to know little, and then pass sentence on matters in that science of which he knows less. The position I then advanced, I would still maintain, that "it became him either to hold his peace, or else to read up, and make himself master of the subject, before thus venturing to pronounce judgment."

In conclusion, I must confess that I am quite willing to plead guilty to any "soreness" or "displeasure" your correspondent may have detected in my last. I freely acknowledge that I was sore displeased to find that a name of so much weight with your readers—that a correspondent who is so active in circulating information through your pages—should have put forth statements so likely to mislead them, so at variance with the principles of sound philosophy. He must be aware that it is more easy to implant "erroneous opinions," than to eradicate them; and that the remedy cannot always follow in the train of the evil.

In his second letter he starts other objections to this conductor; but as I have shown how little he is acquainted with his subject, I do not feel that there is any necessity for me to enter upon these. He starts them without having any certain knowledge of the matter; and my reply, for the satisfaction of your readers, is that they are altogether visionary, and that the lightning rod is not deficient in anything which can tend to the security of the building.

Apologizing for trespassing thus largely on your pages,

I remain, Sir,

Your obedient servant,

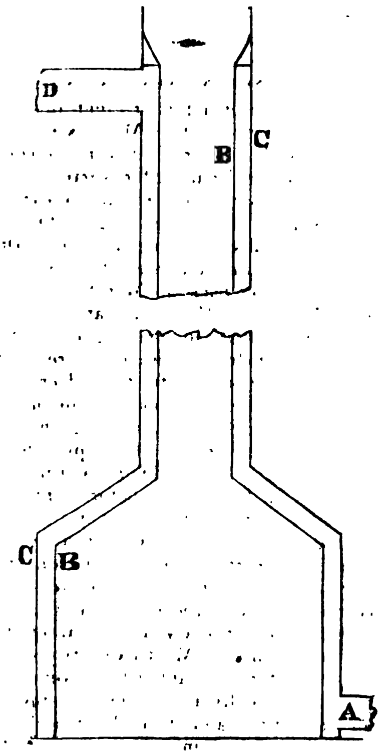
CHARLES V. WALKER.

Westbourne Green,
Sept. 28, 1844.

WARMING AND VENTILATING.

Sir,—I apprehend your ingenious and intelligent correspondent, Mr. Coxworthy, cannot lay claim to originality in the principle of his arrangement for warming and ventilating apartments, which appears in your Number for August, page 120; for it is essentially the same as that of Dr. Jeffrey's Pneumatic Grate, which was described as far back as March 1839, in the *Mechanics' Magazine*, and its superior advantages in ensuring a plentiful supply of moderately warmed fresh air and obviating cold drafts from doors and windows were clearly pointed out in the editorial remarks accompanying the description of the grate. It is a pity that a principle (that of introducing a supply of fresh air to be warmed before entering the apartment,) of the easiest application, and which forms the basis of a system of artificial warming and ventilation, that combines comfort, wholesomeness and economy, should meet with so little regard in the ordinary arrangements for warming houses. Mr. Coxworthy's suggestions offer a valuable adaptation of the principle, equally applicable to a stove or an open fire; and it might readily be brought into use in most houses at the bare expense of an iron flue and casing for the grate, and of forming a communication with the external air from the fire-place. I feel convinced, that the expense would soon be repaid in the economy and saving of fuel; from the heat which at present is dissipated up the chimney, being employed in warming a supply of fresh air for the room, independently of that which is directly radiated from the fire into the apartment. Wishing the best success to every effort like Mr. C.'s for introducing a better system of warming houses, I beg to contribute my mite in the same cause by suggesting a particular application of Mr.

C.'s arrangement; by which, simply at the expense of constructing the necessary apparatus, and without any increased expenditure of fuel, a supply of warmed air may be brought into those parts of a house, as the lobby staircase and passages, which there is seldom any specific provision for warming. The largest and most constant fire in a house is that of



the kitchen, and much unappropriated heat, it is obvious, is continually passing off by the chimney of the same: it is proposed then, to turn this to account, in warming a supply of fresh air for the passages and staircase, or other parts of the house. To do this, as the fire-place and chimney of most kitchens are on a more ample scale than their exigencies strictly demand, it will only be necessary to place an iron casing and flue, B B, within the existing fire-place and chimney, C C, with an interval all round for the circulation of the air. The flue should be carried up to the height of the ceiling, where it is united to the masonry of the chimney; and a communication made with the external air at A, near the bottom of the fire-place, and a tube D, conducted along the ceiling to the passage or staircase, where the current of warmed air discharges itself. This tube being merely a carrier of warmed air should be made of bad conducting materials, or cased in such; and the sides and back of the fire-grate should be lined with fire bricks or metal plates to prevent any part of the iron casing B, becoming so highly heated as to burn or desiccate the air surrounding it. To perfect the arrangement, a circulation, or counter current of air should be established from the lobby, or passage, to the kitchen, by a communication made with the latter near the floor, from whence the air, after performing its office on the fire, would pass into the flue.

I am, Sir, &c.

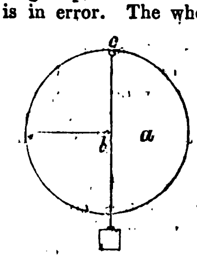
N. N. L.

September, 1844.

THE CRANK AND LIPSCOMBE'S PATENT SUBSTITUTE.

Sir,—Your correspondent, "S. M.," in your last Number, has alluded to my description of Lipscombe's Patent Substitute for the crank, and like all prejudiced persons who have a bad case, does not in the least attempt to disprove any of my statements.

I gave a description of experiments which I performed; therefore, by them my theory was tested. If "S. M." imagined I was wrong, why did he not try those experiments and satisfy himself upon the matter before writing to you? If your correspondent had actually tried the experiment of which he pretends to give an account, he would not have so grossly committed himself as he has. The following experiment will show how much he is in error. The wheel *a* is set



upon an axis *b*; to the wheel is fixed the pin *c*, to which is fastened a cord having a weight suspended to it. Now, by steadying the wheel and suddenly allowing the weight

descend, the wheel will be turned, and the highest point the pin will rise on the opposite side is a little below the horizontal dotted line—the point indicated by the star*. I have tried this experiment very carefully. The axis is of steel, and highly polished, and its diameter $\frac{1}{32}$ part the diameter of the wheel, which is of brass, and 6 inches diameter. Can any experiment more clearly show that half the gravitating force of the weight is wasted?

"S. M." says, "it is as easy for a mechanical mind to conceive a machine to gain power as to lose it, both being alike impossible: a machine can do no more than to transmit or direct." This is a splendid specimen of that nonsense so frequently uttered by crank advocates. Instead of indulging in such generalities, why does he not attempt to grapple with the particular points on which I rest my case? Of you, Sir, as a man of science, I will ask, whether a machine may not be so unmechanically constructed as to produce unnecessary friction between its moving parts, and will not such unnecessary friction require a portion of the motive power of the machine to overcome it, and is not the power expended in overcoming that friction unnecessarily wasted? I know you will say—"Decidedly a machine may be so unmechanically constructed, as that a great portion of the force expended against it, shall be constantly exerted in pressing its moveable parts closely together, and thus produce a great increase of friction between them, and that power which is wasted in producing friction, cannot, of course, be exerted elsewhere at the same time."

A machine worked by steam through the medium of a crank, is precisely one of this kind; the pressure upon a piston is transmitted through a piston-rod, always directly towards the centre of a crank; and does any person pretending to a knowledge of the laws of mechanics, really say that he can transmit power from the piston-rod through the connecting-rod, and from thence against the crank, driving this latter in a circular direction, without causing a great portion of that power to proceed in a direction which cannot be made available by him? If he says he can, I unhesitatingly tell him his mechanical knowledge is slight indeed.

It is sometimes remarked, "that the winch, which has precisely the same action as the crank, has been extensively used in every civilized country for many ages, and it is exceedingly strange, if power is actually wasted by the winch, that it has not long since been detected." On this, I have to observe, that the action of the winch is, without doubt, a perfectly correct one, when forced against by the hand, because the hand and arm accommodate themselves to the varying position of the winch, and by pressing against the winch always at a tangent to the circle, the winch is compelled to transmit all the power exerted against it by the hand in a circular direction. But the action of the crank of an engine is quite a different affair altogether; a crank connecting-rod is inflexible, and cannot therefore accommodate itself to the varying position of the crank, like the hand; instead of pressing (as the hand does) against the crank always at a tangent with the crank circle, it can only do this at one instant of time, namely, at the half stroke. Any person may imitate the action of a connecting rod by keeping his hand and arm inflexible, and he will quickly *feel* that the more he presses against the winch in the direction of its centre, the less able he will be to turn the winch round.

"S. M." does not attack Lipscombe's Substitute for the crank; therefore it is presumed he cannot find fault with it. But what he states respecting connecting-rods is so palpably incorrect, that it stamps him at once as a bad mechanic and an unpractical man. I will not occupy your valuable space in demonstrating to him in what way the connecting-rod misdirects power, as the crank is the chief subject of our present discussion.

The crank is thought very much of, because there is no concussion experienced by it at the end of a stroke, but it is very easy by a particular arrangement of the slide valves in stationary and marine engines to prevent any injurious concussion in Lipscombe's Substitute.

Of all mechanical movements, those whose actions are oblique are the most difficult thoroughly to understand. This remark is borne out by the unnecessary waste of power observable in many machines, and by the very strange opinions entertained regarding the crank, and likewise by the great number of crank substitutes which have from time to time been publicly introduced, and yet not one of them has been found to transmit a greater proportion of power than the crank. The reason is, that most of the inventors of crank substitutes, have either not thoroughly comprehended the effects produced by oblique action, or the amount of resistance produced by friction. The action of the generality of these substitutes was quite as oblique as the crank, but more complicated; the remainder produced such enormous friction between their moving parts, that the loss by friction alone was frequently more than the loss arising from the obliquity of the crank.

There is no necessity for any lengthened controversy respecting any mechanical movement, as we have the mechanical laws to guide us in our theories, and by trying ex-

periments we may test the truth of those theories. A really good mechanician is careful to be unprejudiced when considering a subject, his chief desire being to arrive at the truth. The crank occupies such an important position, that I am sure you will willingly give your numerous readers an opportunity of satisfying their minds as to its real utility. It is a subject which I have employed several years in investigating, and the conclusions I have arrived at, were from the results of very numerous experiments, and I shall feel most happy in assisting any of your correspondents in obtaining a clear impartial view of this important subject.

Apologising for occupying so much space in your very valuable Magazine, I am, Sir,

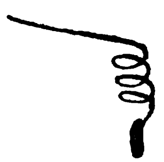
Your most obedient servant,

N.

FOREIGN SCIENCE.

Simple and Sensitive Hygrometer.

M. Coppa has proposed to apply the seeds of various geraniums (not *Pelargoniums* which are popularly called geraniums,) to the purpose of hygrometry These seeds are provided with a long tail or beard, the spiral vessels of which are so sensitive to moisture and drought, that the moment the seeds have arrived at a certain stage of ripeness on the plant they fly out from their receptacles, and instantly twirt or curl themselves up into a close spiral or screw, with the tail, or beard, partly projecting at one end, thus



This tail becomes a natural hand or index when the seed at the other end of the spiral is fixed, and moves back or forward with every hygrometric change. These seeds are very little subject to injury, and M. Coppa proposes little instruments constructed of them as of much service for various agricultural and domestic uses.

The extreme hygrometricity of these seeds was remarked several years ago by Mr. R. Mallet, in a paper published in "Loudon's Gardeners' Magazine." The seeds of the *geranium palustræ*, which is commonly cultivated as a garden flower, answers the purpose of an hygrometer best. Cheapness is certainly one strong recommendation to the use of these seeds for such a purpose, but the evil of all these hygrometers is, the want of fixed or comparable scales.

Preservation of Manures and destruction of their effluvia.

M. Schattenmann, whose improvements upon the macadamization of public roads have become so well known on the Continent, in a letter addressed to M. Dumas, has stated some important results, which he has arrived at, in his experiments upon the application of sulphate of iron or green copperas, for the purpose of fixing the ammonia flying off from putrifying manures, and destroying their odours. He finds that sulphate of iron is capable at once of producing these effects, upon the foulest fæcal matter. The sulphate of iron is applied either in solution or solid; double decomposition immediately takes place; the sulphuric acid quitting the oxide of iron unites with the nascent ammonia or its carbonate, while the liberated oxide of iron is reduced by the sulphuretted hydrogen present, and finally becomes a sulphuret of iron. The results are highly important, for as in every coal district, and indeed in every part of Great Britain, sulphate of iron is a very low priced article, it is in our power at once, by suitable arrangements for procuring a sufficient supply of the solution of this salt to sewers, cesspools, public privies, &c. not only to preserve their contents in the most valuable state for agriculture, but to render them innocuous both while being filled and in the process of emptying. The action of this salt is so energetic, that M. Schattenmann finds that, if mixed with the foulest contents of a cesspool for a very few hours, the whole mass may be removed without any sensible odour.

This information ought not to be lost upon the night-soil men of London and other large cities, but still more should it engage the attention of the Commissioners of Sewers, and most of all, of the Commissioners of the Health of large Towns.

At present, the vast accumulation of manure and fæcal matter from all the large towns and villages in the empire is utterly lost to agriculture, for which it

it is so precious; so very precious, that Boussingault values the solid and liquid excretions of each man as containing about 8¼ kilograms of azote in the year, and capable of producing, if used as manure, 400 kilograms of corn. Yet the utmost difficulties at present attend the use of such manure from the impossibility of collecting it in large masses, without damage to the public health in or near large towns, from the natural antipathy to its manipulation, and from the difficulties attending its collection. All these objections and difficulties, however, are to a large extent removed by this proposal; for, as Mr. Chadwick's invaluable reports upon the sanatory condition of our labouring population point out clearly how a proper system, or several sorts of systems, may be employed to collect and deposit the "*illuvies*" of large towns—so now, the only remaining objection to doing so, viz., the danger to health and comfort is removed.

Thus, if depôts for the manure of sewerage were formed in suitable localities, it would only be necessary to form in the neighbourhood of each a "copperas bed," from which a constant stream of weak solution of sulphate of iron should continually trickle into the mass of manure.

The cost of the salt in Great Britain, would be no more than the interest of the small capital sunk in the bed of pyritose coal to yield the copperas, and the rent of the ground for its deposit.

The establishment of public *mictuarys* also formed to collect all their proper fluids into staunch underground tanks, into which a small stream of solution of sulphate of iron should be conducted, would form another use of this discovery, and the ammoniacal solution being pumped up at intervals, might be sold for manure or for chemical manufactures. Let it be recollected, that Liebig has shown that *every pound weight of the solid contents of urine may produce as manure a pound weight of wheat.* Why should not such public conveniences be largely established in London and elsewhere, either by the Commissioners of Sewers, or police, or by private speculators? To either it would yield an ample return for the capital employed, without any thought as to the more important results, of the improved sanatory condition of towns so provided, and the valuable material presented to agriculture. If it be worth while to send fleets to Africa for guano, it is much better worth while thus to gain these objects and attain all the ends of their voyages, at home, at our very doors.

M. Schattenmann gives some details as to the statistics of expense of this his discovery, showing its profitableness, but these it is needless to transcribe; for if a profit, such as he states, is to be had in Germany, or Belgium, or France, how much more with us, where copperas could be had as an absolute drug, were the means once set in motion for its plentiful production, close to the localities where it would be wanted. It is to be hoped these remarks and this information may not pass wholly unheeded by those whose official positions demand that they should now attend to the subject.

Disinfection of Cesspools and Sewers.

In connexion with the preceding notice of M. Schattenmann's discovery as to the use of sulphate of iron, it should also be remarked, that M. Liret has proposed a more complex material for effecting the same purposes, which he says possesses advantages in *setting*, after mixture with the contents of sewers, &c., and so enabling them to be removed in a more solid form. This, however, on the great scale of systematic working would be an evil rather than a recommendation. The compound proposed by M. Liret, is as follows:—

	Kilograms.
Sulphate of iron	200
Sulphate of zink	25
Charcoal (vegetable)	10
Sulphate of lime	265
	500

75 kilograms of this suffices, he says, to disinfect 500 metres (cubic metres it is to be presumed,) of sewerage.

The gypsum, it appears, is intended to be used in a calcined state.

It is difficult to see the precise aim or use of the sulphate of zink, and its cost would be objectionable.

Photographic Engraving of Copper Plates.

The last great step in the art of copying the images of objects without the artist's aid, has recently been effected by M. Fizeau, of Paris.

Up to the period of his researches the art of copying by the Daguerreotype, had

stopped short at the procuring a shaded picture of an object upon the metallic surface of a silvered plate. The problem which remained to be solved was to find some method by which the surface of this picture could be acted on, so that the dark or shadow parts could be *bitten* or corroded down into hollows, and thus the plate become fit for receiving ink and printing from, as an ordinary copper plate. This M. Fizeau states he has effected, and he has presented specimens of the new art to the Academy of Sciences.

His process is founded on the fact, that the lights of a Daguerrian plate consist of unaltered silver, while the darks, or shadows, consist of mercury, or an amalgam of mercury with silver. He finds that a compound acid consisting of a mixture of nitric, nitrous, and muriatic acids, or of nitric acid mixed with nitrite of potass and common salt, has the property of attacking the silver in presence of the mercury without acting upon the latter. Bi-chloride of copper answers the purpose also, but less completely.

When the clean surface of a Daguerrian plate is exposed to the action of this menstruum, particularly if warm—the white parts, or lights, are not altered, but the dark parts are attacked, and chloride of silver is formed, of which an insoluble coating is soon deposited, and the action of the acid then ceases. This coat of chloride of silver is removed in solution by ammonia, and then acid again, and so on until the depth of *biting-in* is sufficient. However, it is not possible, by repeating this process, to get a sufficient force of impression; a second operation is required, in order to obtain such a depth as will hold the ink to give a dark impression: for this purpose the whole plate is coated with drying oil; this is cleaned off with the hand exactly in the way a copper-plate printer cleans his plate. The oil is thus left in the sinkings, or dark bitten-in parts only. The whole plate is now placed in a suitable apparatus, and the lights, or prominent and clean parts of the face, are gilt by the electrotype process. The whole surface is now touched with what the French engravers call the "Resin Grain," (*grain de Resine*) a species of partial stopping out, and is at once bitten-in to a sufficient depth with nitric acid, the gilding defending completely the lights from all action of the acid. The resin grain gives a surface to the corroded parts suitable for holding the ink, and the plate is now finished and fit to give impressions resembling aquatint. But as silver is so soft a metal, that the surface of the plate might be expected to wear very rapidly, the discoverer proposes to shield it by depositing over its whole surface a very thin parallel coat of copper by the electrotype process; which, when worn, may be removed at pleasure down to the surface of the noble metals beneath, and again, a fresh shield of copper deposited; and so an unlimited number of impressions obtained without injury to the plate itself.

The whole process is singularly ingenious, and occasions will no doubt occur in which it can be made of service; but for very many reasons, that will at once occur to every practical picture engraver, it cannot possibly become a substitute for his delicate manipulations, except in a limited number of special cases.

Printing in Colours.

M. Silbermann, a printer of Strasbourg, has forwarded to the Academy of Sciences at Paris, a specimen (one out of 2,500 impressions) of printing in colours by a new process. These impressions, says the inventor, as they come from the press need no retouching, and, whereas, in the ordinary modes of polychromatic printing, as many plates and separate impressions as there are different colours are requisite, these, his specimens, although printed in twelve different colours, are all from a single plate, and printed at one stroke. No particulars of the process are given, but it seems very probable, that the one plate is inked from twelve other plates of peculiar composition, each leaving its own colour on its required localities upon it.

One obvious advantage of such a process would be, that the relative positions of all the coloured spaces would be greatly more exact, accurate, and clearly defined than if each were printed at a separate stroke and from a separate plate.

New constant Galvanic Battery.

M. Desbordeaux, in a letter to M. Flourens, has communicated a method of using the old and common arrangement of a galvanic trough of zink with double coppers, as invented by Wollaston, so as to become a constant battery. For this purpose it is only necessary to fill the cells with a solution of sulphate of zink mixed

with a little sulphate of copper and sulphuric acid. The current is quite constant for a great length of time, and in place of the battery requiring to be cleaned the strength of the solution of sulphate of zink is constantly augmenting by the metal dissolved. To restore its power when at length it lessens, it is only requisite to add a little solution of sulphate of copper and of sulphuric acid to the fluid in the cells.

Lithographic Transfer of Manuscripts.

M. Lavand, a lithographer of Perigueux, in France, who has, for some considerable time devoted his attention to the means of copying manuscripts, inscriptions, basso-relievos, &c., by means of tracing them off upon a properly prepared paper, one surface of which is chalked, has discovered that, by the admixture of a suitable proportion of fatty matter with the chalk, the trace of an inscription or a manuscript, &c., may be at once transferred to the lithographic stone, from which impressions may be immediately taken. This seems a very obvious, and at the same time valuable invention.

Has any attempt ever been made to transfer manuscripts direct to the lithographic stone by means such as are used in writing with Wedgewood's manifold letter-writer? If the face of the stone were wet, a sheet of the carbonic paper laid on it, and over this, either blank paper for original writing, or a MS., or a diagram, or drawing—why should not the lines be transferred at once by the tracing of the style? If this succeeded, the lithographic art would be at every individual's command.

Elasticity of Metals.

M. Wertheim, whose memoirs upon this subject have been previously noticed in this Magazine, has lately published two, the first upon the effects of galvanic currents, and of magnetism, upon the elasticity of metals, the second upon the effects of very low temperatures upon the same. The following are his conclusions:—

First Memoir.

1. The galvanic current produces a momentary diminution of the coefficient of elasticity in metallic wires through which it passes, and this independent of the diminution due to the elevation of temperature produced. *This diminution disappears with the current, however long it may have been continued.*

2. The amount of this diminution depends upon the force of the current, and probably also on the resistance opposed to it by the conductor.

3. The cohesion of the wire is diminished while the current is passing; but he could not determine whether this was due to the current, or to the elevation of temperature.

4. Magnetization, whether north or south, produces (being excited by the passage of an electric current) a small diminution of the coefficient of elasticity of soft iron, and of that *which remains after the current has ceased.*

Second Memoir.

1. The coefficiency of elasticity of metals decreases uniformly as the temperature rises from $-20°$ to $+200°$ centigrade.

2. Iron and steel are exceptions; their elasticity increases from $-20°$ to $+100°$; but, again, at $+200°$, it is not only less than at 100°, but less than at common atmospheric temperature; so that the curve of elasticity has a point of contrary flexure between 100° and 200° centigrade.

3. The action of low temperatures is not altogether transient, but appears to produce an analogous, but contrary effect to annealing.

These are important results, if to be relied on implicitly.

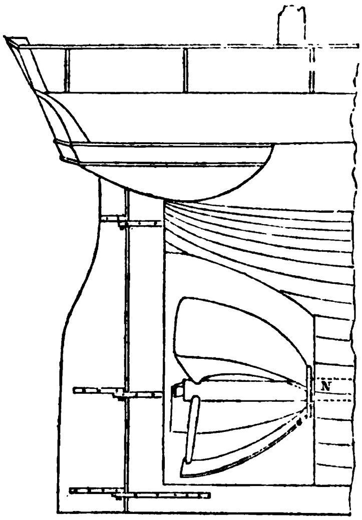
HODGSON'S PATENT STERN PROPELLER.

[Patent dated, February 2, 1844; Specification enrolled, August 2, 1844.]

We witnessed last week a very successful trial of this new stern propeller on the river; but before stating the results of that trial, we must first point out to our readers in what respects this propeller differs from others which have preceded it.

Like other inventions of this class, it has an axis running fore and aft, with blades projecting from it; but these blades instead of being plain like some, or sections of a screw like others, or affixed at right angles to the shaft after the manner of most screw propellers, are each sections of a parabola, and attached to the shaft in positions coincident with the plane of a right cone placed longitudinally with the apex foremost. The general character of the contriv-

ance will be at once understood from inspection of the following sketch:—



Mr. Hodgson's theory is, *first*, that blades of a parabolic form fixed at the angle above shown, must take a better grasp of the water, and have therefore a greater propulsive effect than any other; and *secondly*, that, from the property peculiar to the parabola, that all rays of light coming parallel to its axis are reflected into its focus, so, also, all water thrown off from a blade of a parabolic form must diverge from it in the direction of the focal point, and that consequently a propeller with parabolic blades must allow the water to escape from it much more readily than any other. The theory seems to us to be, in both points of view, well-founded; and it is well borne out by the experiments which we have now to describe.

The boat with which they were made is Mr. Beale's well-known *Pigmy Giant*, which, with her rotary engine, and vertical tubular boiler, was fully described in our 39th Vol., p. 320. The parabolic propeller fitted to her by Mr. Hodgson is 9 inches in length, and 2 feet in diameter. Going with the tide, the boat performed one measured mile in 4 minutes, and another mile in 5 minutes 50 seconds. Returning against the tide she performed one mile and a half in 12 minutes 49″. The first of these performances was equal to 15 miles an hour; or if we deduct 3 for the effect of the tide, equal to 12 through the water. The average of the three trials was a mile in 6′ 28″, or close on 10 miles an hour.

Every one acquainted with the subject will allow that these were great performances with so small a boat, and one too which, from being quite open, is necessarily exposed to more resistance from the air than a decked boat. With a large and powerfully engined vessel like the *Rattler*, we might reasonably expect to see them exceeded by at least one-fourth, and that would give a greater rate of speed than has yet been achieved by screw power.

THE "WONDER" (ATMOSPHERIC) STEAMER.

We announced in our last, that an experimental trial of this vessel, of which we then gave the dimensions, steam power, &c., was to take place on Friday, the 28th ult.; we now give the results. On her way from Blackwall to Gravesend, she overtook, passed, and left far behind her the once far-famed *Railway*. At Gravesend she was challenged by the *Prince of Wales*, which has the reputation of being the very fastest river boat of the present season. The contest was not long, however, doubtful, for though the *Prince of Wales* from drawing less water was enabled to make frequent short cuts by going over the shallows, the *Wonder* soon shot a long way ahead, and reached the Nore so much in advance, as to be able to pass round the bows of the other, on her way back. By some, the superiority of the new steamer over the *Prince* was estimated to be equal to two miles an hour; and by none at less than one. On reaching Gravesend, the *Wonder* came up with the *Meteor*, and there was every promise of a sharp contest between them, but, when off Greenhithe, an accident happened to the packing of one of the pistons of the *Wonder*, which put an end to the race. The greatest speed attained during the day was 14½ miles per hour *against* the tide, which, allowing 3 for the resistance of the tide, was equal to 17½ miles per hour.

PERCUSSION SHELLS—CAPTAIN NORTON IN REPLY TO MR. MALLET.

Sir,—For the satisfaction of and in reply to Mr. Mallet's letter in your Number of Saturday last, I beg to state that, as far

back as the year 1823, I used a suspended bar to explode percussion power at the bottom of a gun-barrel, and also, that as far back as the year 1824, I used an ouncel with its bar and spiral spring to ignite percussion powder within a shell, and that hundreds of naval and military officers, as well as other gentlemen, have seen me do so; and moreover, to the best of my belief and memory, I explained these plans to Mr. Mallet before he *published* in your pages his two methods of effecting the same object. Whether I use one or both of these means in preparing my shells, which have been pronounced by the first authority "to be simple, safe, and efficacious," I must beg leave to decline answering, believing myself fully authorised to use one or both whenever I think proper.

I am, Sir, your obedient servant,

JOHN NORTON.

Gosport, October 3, 1844.

COPYRIGHT OF DESIGNS—CASE OF INFRINGEMENT.

Guildhall, London, October 1, 1844.
[*Before Aldermen Farebrother and Hughes.*]

Mr. May, a hosier in Moorgate-street, was summoned to answer an information filed at the instance of Messrs. Welch and Margetson, of 134, Cheapside, haberdashers, for selling a fraudulent imitation of a part of a registered design for a shirt collar novel in part of the shape of it, not having the license or consent of the registered proprietors thereof, Messrs. Welch and Co.

Mr. Webster, the barrister, in support of the information, stated that his clients were the proprietors of a registered design for an improved linen shirt-collar. The improvement consisted in a new shape given to the two parts of which collars were made. In the old collar a band was cut out straight, and the upper part curved. In the improved collar the band was curved, and the upper piece was straight, and terminated at the whiskers, instead of being continued round to the back of the neck. Mr. May, the defendant, putting the registered article in his window attracted many persons to his shop, but when they were within he showed them what he called an improvement of the registered article, to the prejudice of Messrs. Welch and Margetson. What was called an improvement was a continuation of the upper part of the collar round to the poll of the neck, instead of terminating at the ear. It was merely a fraudulent modification for the purpose of evading the charge of piracy, but as it included all the advantages of the copyright the law would not allow such a subterfuge. In the imitation, the band was curved and the upper parts were straight where they were sewed to the band, just as in the original design, and of course they fitted with the same comfort.

Mr. Alderman HUGHES said, the question then was, whether the defendant had sold an article in which the registered design was wholly incorporated, though yet not a complete imitation.

Mr. Alderman FAREBROTHER thought it odd that such a thing should be registered at all. It seemed too trivial a matter to be the subject of copyright.

Mr. Alderman HUGHES said, the mere shape of a frill with flowers interspersed had been made the subject of a register.

Mr. Alderman FAREBROTHER said the whole thing was so silly that he doubted if it could be protected by the act. A man obtained a patent for making a shirt-collar fit a little higher, or lower, or closer; then the price of the article was to be kept up to his mark, and nobody could cut out a shirt-collar without the risk of infringing on his copyright. The object of the act was to secure reward to great skill and ingenuity.

Mr. Alderman HUGHES said, that the moment he saw the new collar he saw it was an improvement on the old shape, and he should patronize it. He had no doubt it was a proper subject for registration. Many of the inhabitants of his ward were engaged in trade that required the constant protection of the law to their original patterns, and this had drawn his attention particularly to the subject. The registering of a design was sometimes worth 3,000*l.* to the inventor. As many as 23,000 articles had been registered since the act came into operation, and it would be to little purpose that the registration might be effected if a poor man could only defend his right by an action at law. He thought a summary interposition of the magistrates was the proper way to protect inventions.

Mr. Alderman FAREBROTHER yielded to the opinion of his brother magistrate. It seemed difficult to decide where the improvement was so small.

The magistrates having consulted decided that the imitation was an infringement of the registration, and fined the defendant 5*l.* for selling it.

Mr. Webster said he waved the claim to any costs as counsel's or attorney's fees. He only asked for the costs of the court, 4*s.*, and he begged, on behalf of Messrs. Welch and Margetson, to leave the fine for the Distressed Needlewomen's Fund or Society.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1105.] SATURDAY, OCTOBER 12, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

THE PATENT NAUTILUS, OR PORTABLE LIFE-PRESERVER.

Fig. 2.

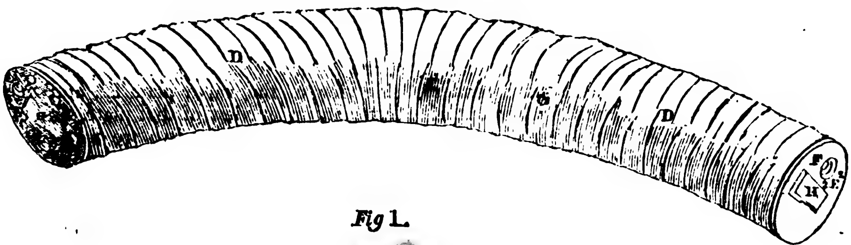


Fig 1.

Fig 3.

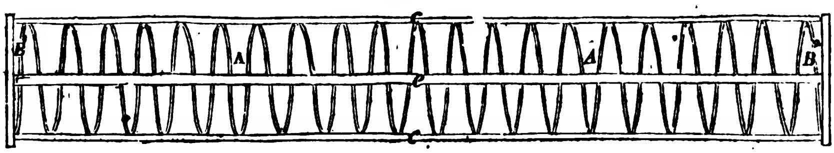


Fig 4.

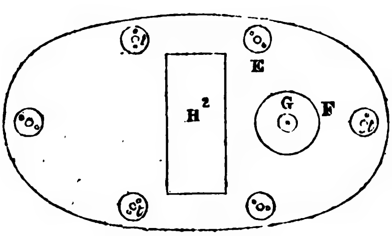
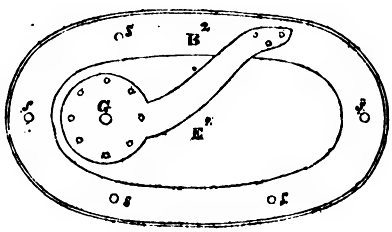


Fig 5.



SPICER'S PATENT NAUTILUS, OR PORTABLE LIFE-PRESERVER AND SWIMMING-BELT.

[Patent dated March 28, 1844; Patentee, Chas. Wm. Spicer, Esq.; Specification enrolled, September 28, 1844.]

Of all the marine life-preservers, which have come under our notice, this is by far the most scientifically constructed, and we make no doubt it will prove also the most decidedly efficient. Instead of being, like some, in a state of permanent distension, and consequently bulky and cumbersome; or requiring, like others, to be inflated by the breath at the moment of use, when people have but too often neither the time nor calmness necessary for the purpose; or, like a third class, which a puncture or rent may render utterly useless; the Nautilus when out of use may be packed into so small a compass as to be carried conveniently in the pocket, is instantaneously expanded by a very slight effort of the hands, and will resist, to very tatters, the assaults of winds and waves, without collapsing.

Fig. 1 is a view of this apparatus when in its complete and portable state, ready for use. Fig. 2 is a view of it when distended. Fig. 3 is a skeleton view of it with the outer covering removed. Figs. 4 and 5 are separate views of the end pieces on an enlarged scale. A A is an elastic spiral frame of metal, the two terminal coils of which are rivetted to the inside of two broad metallic rings, B^1 B^2. C C are pieces of tape, (two, three, or more,) of the utmost length to which the belt is meant to be distended when in use, which are attached at the two ends to the rings B^1 B^2, and intermediately to each of the coils of the spiral frame, as shown in the skeleton view, fig. 3; so that the elastic spiral frame can be drawn out no further than the tapes will allow, and its coils, when under distension, are kept by the tapes at about an equal distance from one another. D is an exterior covering of caoutchouc, or any other sort of waterproof cloth, which is drawn loosely over the spiral frame, and doubled at the two ends over upon the rings B^1 B^2, where they are hooked on to the screwed studs *s s s s* (see figs. 4 and 5). E^1 E^2 are two external valve plates of the shape of the rings B^1 B^2, and with holes in them to correspond with the projecting studs *s s s s*, which being slipped upon these studs, atop of the overlapping ends of the cover, are brought tight up, and made fast by the screw nuts *t t t t*. These plates may consist either of wood covered on the outside with metal, as represented in the drawings, or wholly of metal; and instead of screwed studs, as represented, plain studs may be used, and the ends burred up. F F are orifices in the plates E^1 E^2, and G G valves adapted to these orifices; the latter being attached to spring levers fixed to the under rings B^1 B^2. The position and office of these valves are particularly shown in the engravings, figs. 4 and 5, the former of which is an outside view of the valve plate E^1, and the latter an under view of that plate, and of the ring B^1, when the two are made fast together in the manner before explained.

When it is desired to distend the belt, the party using it lays hold of it by the two ends, and presses by his thumbs the two valves G G inwards, which, admitting the air into the inside, enables him to draw out the belt to its full extent. On removing his thumbs, the valves spring immediately back into their place, and the included air having then no sufficient means of escape, the belt remains in its distended state, and is in that state to be fastened round the body by means of the spring catch H^1 at one end, and the hasp H^2 at the other.

When the belt has rendered the service required of it, it can be readily restored to its originally portable size by opening the valves G G, and pressing out the air.

MR. SCOTT'S THEORY OF PARALLEL LINES.

Sir,—I think your correspondent "K. L." has been rather premature in making his remarks on Mr. Scott's 3rd Problem (No. 1088). He should have waited until Mr. Scott had brought his demonstration to a termination. "K. L." states (No. 1100) that among Mr. Scott's diagrams, we have "two parallelograms A B C D, F G H K, in which F G = A B and G H = B C. The angles A B C D are all equal, and they are supposed to be acute, whereas, F G H and F K H are right angles." "From such premises," he adds, "it is easily shown that the two remaining angles F and H, of the second parallelogram are still more acute than those of the first," &c. Had Mr. Scott called his

diagrams parallelograms he would have been highly deserving of censure, for he would have been trespassing on forbidden ground. But this Mr. Scott carefully avoids, never overstepping the proper limits. "K. L." has also partially stated Mr. Scott's data (see Props. 1st and 3rd, Nos. 1088 and 1102); and with regard to "K. L.'s" assertion, "that it is easily shown that the angles of the second figure viz., F and H, will be still more acute than those of the first." If "K. L." will give us a demonstration of this we shall esteem it a great favour; but he must confine himself to the proper limits, that is to say, he may call to his assistance any proposition from the 1st to the 28th inclusive. But "K. L." will find upon trial, that it is not so easily done as he imagines. He will find that he must first establish the truth of the following theorem, viz., "that the sum of the four angles of any plane quadrilateral is equal to the sum of the four angles of any other quadrilateral, or what is the same thing, the sum of the four angles of any quadrilateral is a constant quantity. If "K. L." succeeds in giving us a demonstration of this theorem, I will undertake to give a demonstration of the 32nd proposition in a dozen of lines, and thus effectually remove a blemish from the elements of Euclid.

Mr. Scott's demonstration of his 3rd proposition is indirect, requiring what is called the *reductio ad absurdum.* This does not seem to please "K. L." Mr. Scott, he says, "makes a false supposition." This assertion is certainly true. But did "K. L." ever see a proposition, the demonstration of which required the *reductio ad absurdum* method, that was not founded upon a *false proposition?* Let him examine the First Book of Euclid, and he will find, that of 48 propositions, 11 of them require the *reductio ad absurdum* method; and in the 3rd, out of 37 propositions, 14 of them require the same method, or the truth of all these propositions are made out from *false suppositions.*

The concluding parts of "K. L.'s" remarks are not deserving of much notice: the account he gives of the curious method given by Mr. Meikle in Jameson's Journal, and noticed in No. 1080 of your Magazine, I have never seen. But in turning to the number of the Magazine referred to by "K. L.," we find that your Glasgow correspondent, Delta, states that from what is found in the Edinburgh Journal, it is expected that it may *yet lead* to a satisfactory demonstration of Euclid's 12th axiom.

In conclusion, I shall only add, that if Mr. Scott has overlooked anything in his theory of parallel lines, "K. L." has not discovered it.

KINCLAVEN.

October 2, 1844.

P.S. The printer has evidently misplaced Mr. Scott's diagrams. Fig. 2 should have been marked fig. 3, and placed in page 199, and that in 199, in page 198.

THE CALCULATOR, NO. XIV.

In my last communication on Savings Banks, I left unexplained the "profit arising from the course of dealing," denoted in the formula by n.

This arises from regulations, which are very generally adopted, for the sake of simplifying the accounts, and they produce an amount of profit not to be disregarded in calculation. 1. By not computing interest on fractional sums. 2. By not paying in interest, any fractional part of a penny. 3. By requiring notice of withdrawing money, and not computing interest subsequent to the date of the notice.

Let c represent the number of open accounts in the ledger, so that $\frac{h}{c} = v$, the average of all the depositors' balances: this value, for any particular bank, will be found almost constant.

If the rule be, that no fractional part of a £ shall bear interest, the average value of that fraction will be found to be 7*s*. 6*d*., or 0·375.

The profit by not paying fractions of a penny in interest, is evidently a halfpenny for each account = 0·00208 c.

And the value of that part of n, arising from the first two sources, is

$$0·375\, c\, r \;+\; 0·00208\, c:$$

then adopting ·03 as an assumed value of r, it becomes $= 0·01333\, \frac{h}{v}$.

The third head of profit may be easily ascertained at the end of any year, by the amount of repayments made, but it is evidently a source not so easily anticipated as the others; and therefore, in preparing

data for calculation, it will be prudent to take a *minimum* rather than an *average* of the last 5 or 7 years.

I believe that by pursuing an investigation upon the principles already laid down, the managers of any bank will arrive at a just and safe conclusion as to the rate of interest hereafter to be allowed; and moreover, that the affairs of any bank *stand in need of reformation*, in which it shall appear that the treasurer's balance is upon an average greater than $f + \cdot 0075\,h$, or the expenses of management than $80 + \cdot 00225\,h$.

J. W. WOOLLGAR.

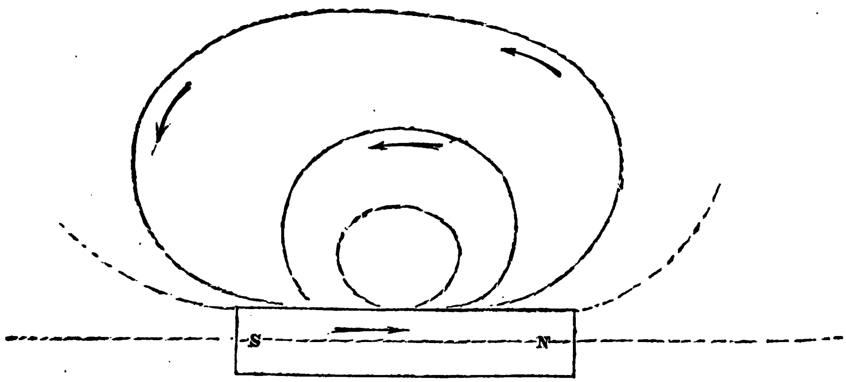
Lewes, October 5, 1844.

Corrigenda in the previous paper, page 213. Line 21, col. 1, for *these* read *this;* line 31, dele *the;* line 36, col. 2, for *u* read *n*.

WHAT IS THE CAUSE OF MAGNETIC PHENOMENA? ANSWERED BY MR. G. VINCENT TOWLER.

[Being in continuation of preceding papers on the subject in the *Mechanics' Magazine*.]

Magnetic phenomena are due to the perpetual motion of particles of fluid matter about a magnetic body, which particles of fluid matter enter on all points of one half, and issue from all points of the other half of the surface of a magnetic bar; and circulating round the body, again re-enter it.



Suppose we take a small bar of steel or iron, and bring a suspended needle into its vicinity, no magnetic effects will ensue; but if after the bar of steel or iron has been placed in a vertical position, and struck on its top with a hammer a few times, the suspended needle be again presented to it, magnetic phenomena will be almost instantaneously exhibited between them.

As these bodies were not magnetic before the strokes, but became so immediately after, and there is no other cause operating to produce such effects, it may be assumed,

Firstly,—That magnetism is an effect which is produced by percussion.

As magnetism is an undoubted effect which results from percussion, it is our first business to examine into the effects produced on bars of steel, or iron, by percussion. We cannot do this more judiciously than by first turning our attention to the nature of the effects produced, and the character of the phenomena resulting therefrom. In what do these effects, namely, magnetic phenomena, consist?

The most prominent features of them are attraction and repulsion, which is nothing more than a motion of the poles of two or more magnetic bodies, bearing the same name, to the greatest possible distance from each other; and the nearest approximation at the same time of the poles bearing opposite names to each other; such approximation being a direct consequence of the repelling principle, and *vice versâ*. The other phenomena being all of a corresponding cha-

racter require no comment here. In fine, the more we search into these phenomena, the more we become convinced of their mechanical nature. What else, it may be asked, should we expect to result from mechanical causes?

Iron and steel being conductors, we know that they have interstices, and also that these interstices can and do contain particles of fluid matter, and further that the fluid matter so contained in them, is much more susceptible of motion from minute external forces which they may be exposed to, than the fluid particles in the interstices of bodies which do not conduct; for instance, the particles of fluid matter in the interstices of metallic substances are disturbed by less force or pressure than those contained in the interstices of wood or stone.

As percussion produces a disturbance of the particles of fluid matter in all cases, and under what circumstances soever it is brought into action, what is there, in the name of reason, to prevent its producing the same effects in steel and iron, that it does in and about other bodies?

As we have no evidence whatever of any but mechanical results that arise from percussion, why should we shut our eyes to these, and set out in search of others which we know not of? If the mere motion of matter, independent of any other attribute which it may or may not possess, be sufficient to produce all the phenomena we are cognisant of, why should we be led to suspect the existence of other causes? As we cannot strike wood, or stone, without producing a vibration of their parts, and a consequent disturbance of the particles of fluid matter contained in them, how much less so can we strike bars of iron, or steel, without producing the same results? It may be assumed,

Secondly,—That it is a moral impossibility to strike metallic substances with any degree of force without producing a disturbance of the particles of fluid matter contained in their interstices; consequently, when a bar of steel or iron is struck forcibly with a hammer, a disturbance of the particles of fluid matter contained in their interstices is an inevitable consequence.

Now, as we produce a motion of the particles of fluid matter contained in the interstices of all substances, or bodies, that we apply an adequate force, by percussion to, in wood, and stone, as well as iron; but as in wood or stone this motion ceases immediately after the cessation of the applied force, and in steel, iron, and some few other substances, it remains, or is continuous, we arrive at the conclusion,

Thirdly,—That the grand distinction between magnetic and non-magnetic substances is, that one class, namely, the magnetic, possess some power or attribute of perpetuating the motion of fluid about them, when once imparted; and the others, namely, the non-magnetic, are devoid of this principle or attribute.

We are now come to a very important and interesting point in this enquiry, namely, How, and why do magnetic substances perpetuate a continuous motion of fluid matter about their surfaces?

In searching into this property, or attribute of magnetic bodies, it is necessary first to determine the course, or direction, given to the particles of fluid, when the disturbance which is effected by percussion takes place.

When we strike a bar of iron for the purpose of rendering it magnetic, it is essential that it should be in a vertical position, and also that the strokes be applied at the top of it. Now it is evident the same direction takes place in regard to the fluid in the bar, as is the case in any other respect where an impetus is given either to a body, or the fluid particles resident in it, namely, that the direction or course of the fluid is in a right line, and opposite to the force applied. Consequently, the particles of fluid are driven from the top to the bottom of the bar. There is abundant evidence to show, if such were necessary, that the motion or direction of the fluid through a magnetic body, is from one pole or extremity to the other, but as this is so familiar to the enquirer more need not be adduced as regards the direction of the fluid. We may therefore add,

Fourthly,—The fluid passes through a magnetic body from one pole or extremity to the other.

Now, if fluid be made to pass from one extremity to the other of a metallic bar, and the bar does not derive the fluid which it is so conducting from such a source as a galvanic trough, battery, or any reservoir, excepting the atmosphere which surrounds it, the conse-

quence is, that the pre-existing quantity of fluid in the space immediately surrounding that pole at which the fluid enters, must become so much rarer in proportion to the quantity of fluid which the bar conducts from it. And as the bar cannot take in fluid without giving out fluid, the pre-existing quantity in the space surrounding the opposite pole becomes in the same time as much denser of fluid, as the other becomes rarer: therefore,

Fifthly,—A bar of metal conducting fluid under the aforenamed circumstances generates a rarer atmosphere at one extremity, and a denser at the other, than would be found on its extremities, were it not conducting fluid.

No magnetism is induced instantaneously, although in many instances little time is necessary to generate it; *but unless the means of induction be continued until there is a connexion formed externally between the poles, no permanent magnetism ensues.*

We have just seen the consequences of a short metallic bar conducting fluid which it derives from the atmosphere surrounding it; and as it is a demonstrable fact, that unless there is an external, as well as an internal connexion formed between the poles of a bar of steel, or iron, it cannot become a permanent magnet; we are enabled in the first place to discover the nature of the connexion which takes place, which is,

Sixthly,—That the redundant fluid on one extremity of a magnetic bar is continually flying in to restore the equilibrium which is destroyed by the constant absorption of fluid by the other.

Let us now consider the consequences of such a motion, or arrangement of fluid matter, as regards the external upon the internal fluid. We are well assured of a continuous motion of fluid about a magnet—we have arrived at certain absolute consequences attendant upon induction by percussion—and there are no other that can under any circumstances take place—so that it only remains for us to discover in what manner the distribution of fluid now under consideration, perpetuates the motion which the percussion produced.

It must here be borne in mind, that steel and iron are conductors, and although they do not conduct fluid so perfectly as denser metals, nevertheless it will be found that they conduct fluid to short distances under considerably less pressure than any other metal.

Now it is a well-established fact, that there are no magnetic effects but between two or more magnetic bodies, that is to say, there is no magnetic attraction, or repulsion, but between two or more magnets. Therefore, if we take a minute suspended needle, and bring it into the vicinity of an unmagnetized mass of iron, and we see a magnetic action take place between them, we are therefore certain, that the needle has magnetized the mass of iron, or no magnetic effects would have resulted.

Now the fluid entering in, or issuing from the needle, does so with so little force that it is inappreciable by the most delicate tests that ingenuity can suggest. But although so minute, it is capable of generating a motion of fluid in the mass of iron, at a distance perhaps of two or three feet, thereby rendering it magnetic. More than this needs not be said to convince the most sceptical of the sensitiveness of iron and steel as conductors.

I have before shown that no permanent magnetism is induced in a body, unless the inductive process generates a connexion externally as well as internally, between the poles of that body. I have also shown the nature of the connexion, namely, the redundant fluid which the magnet conducts to one extremity, flying back to restore the equilibrium which is destroyed by the absorption of fluid by the other. This external connexion has long been familiar to the magnetic enquirer, and although every one knows that either pole of a magnet will magnetize bars of iron at distances considerably exceeding those of one pole of a magnet from the other, yet the grand secret, the *sine qua non* of the phenomena of permanent magnetism, has hitherto lain concealed, which is,

Seventhly,—That each half of a magnet is continually magnetizing the other.

Although it has been shown that each half of a magnet is continually magnetizing the other, the question why, and how is this motion of fluid perpetuated, still remains to be answered.

Eighthly,—The mechanical contexture of iron and steel renders them conductors of the most sensitive nature that the mind can

well conceive, and when by any means short bars of them are made to conduct fluid under minute pressures, and an external connexion is formed between the poles, the negative, or absorbing pole is continually withdrawing fluid from the positive, or emitting pole; and, consequently, reducing the external pressure upon the internal fluid at that pole to a minimum, at the same time, the pressure on the fluid at its own pole, becomes a maximum. Thus, as long as the fluid flows through the body, so long will there be a continual external augmentation of pressure at one pole, and a corresponding diminution of it at the other, and as long as such is the case, the fluid will continue to flow through the body, and the internal action reciprocate the external, and vice versâ.

I have said above, that the fluid enters on all points of one half, and issues from all points of the other half of a magnetic body. I have not adverted to this before, as it might have engendered a confusion of ideas. That such is the case becomes evident in all cases of induction, that is to say, that the fluid in the interior of the body, when undergoing a disturbance, will issue from any other part of the body as well as the immediate pole, and of course fluid can enter in any other part as well as issue—that if the fluid enters at one pole, and issues from the other, it must necessarily, in a body of uniform texture, enter also on every point of one half, and issue from every point of the other half.

The consequences of such a perpetual circulation of fluid, as regards the known phenomena resulting therefrom, must form the subject of another paper.

MR. JOPLING'S SEPTENARY SYSTEM OF CURVES.

Sir,—I have had great satisfaction and amusement in making use of that beautifully simple instrument, Mr. Jopling's curve tracer, and I think it would tend to a more general and combined acquaintance with it, if some conventional symbols were adopted, by which every curve might be accurately signified. By this means a complete registry might be kept of those curves interesting from their beauty or utility, and any particular one reproduced when desired, at any time, and by any instrument on the same principles.

Call the three limbs, or bars of the instrument, x, y, z, and let the holes be equidistant, the distance between each pair being the unit of measurement. Call the distance between the *fixed* pins d. Now, if we count the number of units from the hole in which the pin connecting x and y, revolves in y, to the one where the pencil is fixed, and call it $+p$ or $-p$, as it is to the right or left of the $x\ y$ pin, we have a simple and perfect mode of designating any position of the instrument.

According to this notation the *equation* to the curve, fig. 1, is $3x+4y+3z=3d+3p$.

Also the equation to curve, fig. 2, is $2x+4y+4z=5d-p$.

Fig. 1.

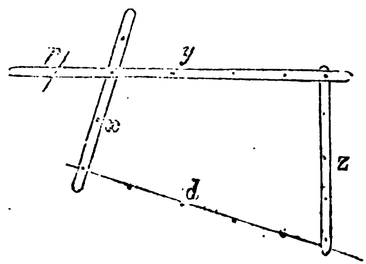
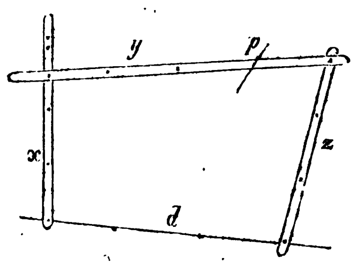


Fig. 2.



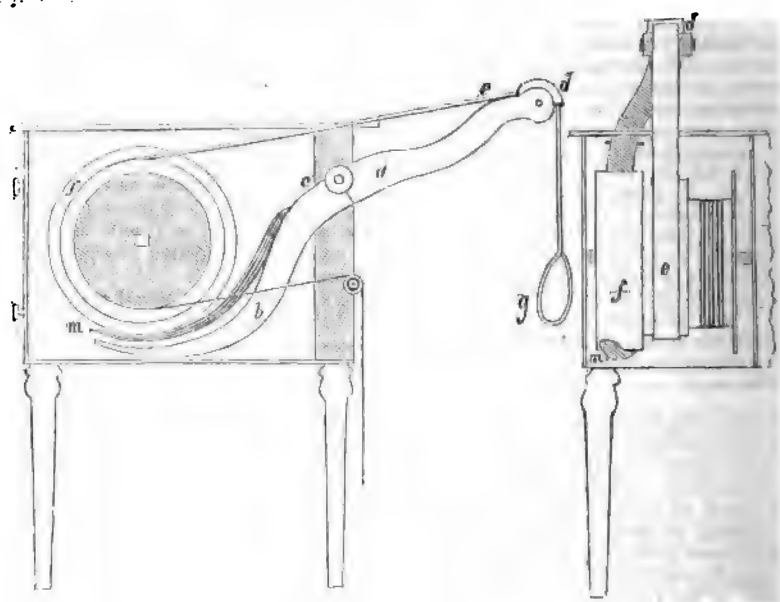
The algebraical form which some of the results assume is very singular, and we may also investigate what form of equation produces two distinct symmetric curves by the motion of the pencil. These and other curious properties I may trouble you with at some other time,

I am, Sir, yours, &c.

J. M.

Drumcondra, Dublin.

TAYLOR'S PATENT DOMESTIC FIRE-ESCAPE.



Sir,—I believe, that, notwithstanding the numerous contrivances for escape from fire, a really efficient one is still a desideratum. I think, also, you will admit that an apparatus which does not require to be *brought* to the scene of danger, but which is instantly at hand, of cheap and simple construction and capable of being used as a dressing table or other convenience, (the machinery being entirely concealed,) is of all others the most eligible. I beg therefore to submit for the consideration of your readers the above sketch of Mr. Taylor's patent domestic fire-escape. This apparatus, when exhibited at the Society of Arts drew forth the strongest testimony of their approbation, as an entirely new arrangement of mechanical power in connexion with the crane, and eminently adapted for this special purpose.

The possessor of one of these has only to lift up the lid forming the top of the dressing table, throw out the arm which is folded back inside, attach himself to the end of the band by a belt or bag, (which is kept in the apparatus) and without the slightest assistance from any one he will descend steadily and without the least concussion to the ground, the ease and velocity of the descent being self-regulated by the weight of the person descending acting on a spring, which presses against the drum, and causes just that degree of friction which is proportionate to his own weight, *the velocity remaining the same whether it be the weight of a heavy man or only that of a child.* As soon as one person has descended and detached himself, the pressure is entirely removed from the drum, and the band is re-coiled with great rapidity, and ready for another descent by pulling the cord, reversely coiled round another division of the drum, by the same action that lowers the band. In this manner, at a recent trial of its powers at a house in St. Martin's-lane, I saw ten or twelve persons descend from the attic window in less than that number of minutes, no assistance whatever being given to any of them. This was witnessed by hundreds of persons with great applause, many of whom said it was absolutely impossible for anything to be more simple and effectual in its action.

Description.

a b is a lever turning on a fulcrum at *c*, and formed with a hinge shoulder, for the purpose of being turned back over the apparatus when not in use, but acting as

an entire lever in the other direction; over one end of this lever at *d*, passes a strap or band *e*, which is coiled round a drum, or barrel *f*; the other end of the band is formed with a loop *g*, to which may be attached a bag, body belt, or other appendage; *m* is a spring, (the main feature of the invention,) which, being fixed at one end to the lever presses at the other end against the barrel or drum, with a force exactly proportioned to the weight supported by the lever or arm of the apparatus, and forming the precise degree of friction or check, to allow of a gradual and easy descent. The whole apparatus may be contained in a cube of about 15 inches.

I am, Sir, your obedient servant,

J. FANCUTT.

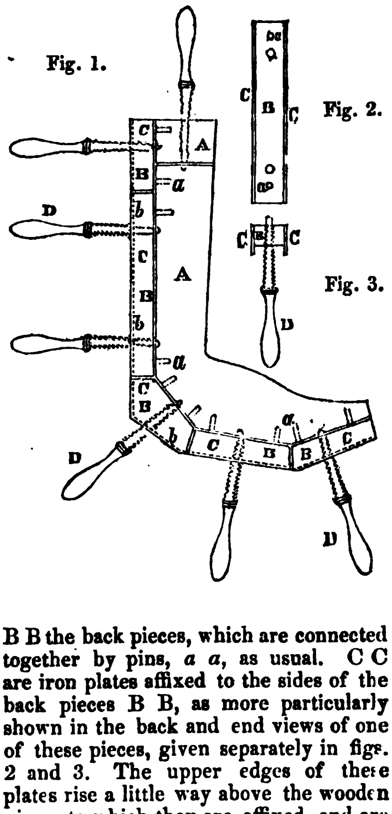
No. 55, Southampton-street, Pentonville.
Sept. 28, 1844.

HUTCHINGS'S REGISTERED BLOCKING MACHINE.

[Registered under the Act for the Protection of Articles of Utility.]

No one who has ever seen a boot in the process of blocking can have failed to be struck with the violence of the exertion which it requires, or with the risk of injury to which the leather is exposed, from excessive stretching in some places compared with others, or from a careless use of the powerful pincers employed. All these objectionable circumstances are more especially observable where the fronts, or *vamps*, as they are technically called, are of the glazed or patent leather so much in vogue, on the surface of which the least distortion makes a most perceptible impression. By means of the ingenious machine represented in the accompanying engravings, blocking, which has been hitherto so laborious, uncertain, and hazardous a process, will become henceforth one of the easiest, surest, and safest. It will require no more force, and hardly more skill, than the youngest apprentice can command. Tacks, pincers, and hammer will be no longer needed. The mere turning of a few screws will do all the business. And as the stretching at every part can be literally done *to a turn*, the leather must of certainty be less injured, and therefore both look and wear better.

Fig. 1 is a side view of this blocking machine. A A are the front pieces, and



B B the back pieces, which are connected together by pins, *a a*, as usual. C C are iron plates affixed to the sides of the back pieces B B, as more particularly shown in the back and end views of one of these pieces, given separately in figs. 2 and 3. The upper edges of these plates rise a little way above the wooden pieces to which they are affixed, and are pierced with a number of holes, *b b b b*. When the front leather of the boot or vamp is brought over the combined set of blocks, instead of the two edges being connected at the back by cross lacing as usual, each edge is tacked, independently of the other, to the iron plates C C, which are provided with the holes *b b*, for the purpose as before explained. D D D are a series of hand-screws inserted through the back pieces B B, by the turning of which outwards, after the leather has been secured in its place by the means before described, the leather can be stretched in every part, and to any extent required.

THE BRITISH ASSOCIATION—YORK MEETING, 1844.

[Selections from the Reports of their Proceedings in the *Athenæum* and other journals.]

The Great Rosse Telescope.

The Earl of Rosse stated that the Council having intimated their opinion that some account of the experiments in which he had been engaged on the Reflecting Telescope would not be altogether devoid of interest, he would endeavour to describe, as briefly as possible, the manner in which he had attempted to accomplish the object in view, and the principal results obtained. When, about the year 1826, he first turned his attention to this subject, he considered that the knowledge of our own system might be almost considered complete. There were, no doubt, some portions of it, as the motions and distances of the satellites of Uranus, the masses of some of the planets, the rings of Saturn, and some others, which yet required elucidation, and would doubtless amply reward industrious research; but on the whole, he conceived that our ordinary instruments, aided by the nice contrivances for accurate measurement which the perfection of modern art had introduced, were amply competent to aid in this branch of research the many men of genius who were engaged in it. But a new and a most interesting field had been opened to the view, and partially explored, by the indefatigable zeal of the distinguished Herschel, and his no less distinguished and accomplished son. The subject of double and multiple stars promised a rich harvest, if our instrumental powers could be enlarged to any considerable extent; and another field, no less promising, was that of nebulæ, of which some of those examined by the Herschels seemed to lay open to the contemplation of the astronomer regions, in comparison with which our entire sidereal sphere might be considered as a mathematical point. Now, in examining these, he did not mean to deny that accurate measurements were of much importance—indeed, of the very highest; but it must be obvious, that before we can measure we must be rendered capable of seeing. Here, then, he found the strongest inducement to attempt to improve the instrument by which this was to be accomplished. Two objects required to be kept in view: first, to give the telescope sufficient aperture to secure a sufficiency of light; secondly, to increase to a sufficient extent the magnifying power. On these depended what might be called the optical power of the instrument, but particularly upon the former. For instance, the large telescope, of which a model stood before them, to be used effectually, must have a magnifying power of 300 times. Now, another instrument, very inferior in size, might have a much higher power, but, from the vast quantity of light which it collected into the image, objects in it became distinct which could not be at all seen by those of inferior aperture. The next question he had to determine was, whether he should attempt refractors or reflectors. Just at that time very large and very fine discs of the proper glass had been produced upon the Continent, and a strong hope was entertained of bringing the refracting telescope to a degree of perfection which had been hitherto rather hoped for than attained. But, upon a calm balancing of all the difficulties which opposed their construction, he determined to attempt the improvement of the Newtonian reflector, and that notwithstanding it was well known that an error of form of the reflector produced an error in the image more than five times as great as the same error in the refractor would produce. It was to the steps by which he attained this object that he was now about to direct the attention of the Section.

"Having concluded that, upon the whole, there was a better prospect of obtaining by reflection, rather than by refraction, the power which would be required for making any effectual progress in the re-examination of the nebulæ, the first experiments were undertaken, in the hope of obviating the difficulties which had previously prevented the application of the brilliant alloy which may be formed of tin and copper in proper proportions to the construction of large instruments. The manner in which the difficulty had been met, was, by adding an excessive proportion of copper to the alloy, but the mirror was no longer susceptible of a durable polish, and, when used, its powers declined rapidly. It appeared to me, therefore, to be an object so important to obtain a reflecting surface which would reflect the greatest quantity of light, and retain that property little diminished for a length of time, that numerous experiments were undertaken, and perseveringly carried on. After a number of failures the difficulties appeared to be so great that I constructed three specula, where the basis of the mirror was an alloy of zink and copper in the proportion of 1 zink to 2·74 copper, which expands with changes of temperature in the same proportion as speculum metal. This was subsequently plated with speculum metal, in pieces of such size as we were enabled to cast sound. These specula were very light and stiff, and their performance upon the whole satisfactory; but they were affected by diffraction at the joinings of the

plates; and although very brilliant and durable, defining all objects well under high powers, except very large stars, still, as the effect of diffraction was then perceptible they could not be considered as perfect instruments. In the course of the experiments carried on while these three specula were in progress, it was ascertained that the difficulty of casting large discs of brilliant speculum metal arose from the unequal contraction of the material, which, in the first instance, produced imperfections in the castings, and often, subsequently, their total destruction; and it appeared evident that, if the fluid mass could be cooled throughout with perfect regularity, so that at every instant every portion should be of the same temperature, there would be no unequal contraction in the progress towards solidification, nor, subsequently, in the transition from a red heat to the temperature of the atmosphere. Although it was obvious that the process could not be managed so that the exact condition required should be fulfilled, still, by abstracting heat uniformly from one surface (the lower one), the temperature of the mass would be kept uniform in one direction, that is, horizontally; while in the vertical direction, it would vary in some degree as the distance from the cooling surface. These conditions being satisfied, we should likewise have a mass which would be free from flaws, and, when cool, would be free from sensible strain; nothing could be easier than to accomplish this, approximately, in practice; it would be only necessary to make one surface of the mould (the lower one,) of iron of a good conducting material, while the remainder was of dry sand. On trial, this plan was perfectly successful; there was, however, a new, though not a very serious defect, which was immediately apparent—the speculum metal was cooled so rapidly that air-bubbles remained entangled between it and the iron surface; but the remedy immediately suggested itself, by making the iron surface porous, so as to suffer the air to escape; in fact, by forming it of plates of iron placed vertically side by side, the defect was altogether removed. It only then remained to secure the speculum from cooling unequally, and for that purpose it was sufficient to place it in an oven raised to a very low red heat, and there to leave it till cold, from one to three or four weeks, or perhaps longer, according to its size.

"The alloy which I consider the best, differs but little from that employed by Mr. Edwards: I omit the brass and arsenic, employing merely tin and copper in the atomic proportions, namely, one atom of tin to four atoms of copper, or, by weight, 58·9 to 126·4. As it was obviously impossible to cast large specula in earthen crucibles, the reverberatory furnace was tried; but the tin oxidized so rapidly, that the proportions in the alloy were uncertain; and after some abortive trials with cast-iron crucibles, it was found that when the crucible is cast with the mouth up, it is free from the minute pores through which the speculum metal would otherwise exude; and therefore such crucibles fully answered the purpose. It was very obvious that the published processes for grinding and polishing specula, being in a great measure dependent on manual dexterity, were uncertain, and not well suited to large specula; accordingly, at an early period of these experiments, in 1827, a machine was contrived for the purpose, which has subsequently been improved, and by means of it a close approximation to the parabolic figure can be obtained with certainty; as it has been described in the Philosophical Transactions for 1840, it is unnecessary to do more than to point out the principle on which it acts. The speculum is made to revolve very slowly, while the polishing tool is drawn backwards and forwards by one eccentric or crank, and from side to side, slowly, by another. The polishing tool is connected with the eccentrics by a ring, which fits it loosely, so as to permit it to revolve, deriving its rotatory motion from the speculum, but revolving much more slowly. It is counterpoised, so that it may be made sufficiently stiff, and yet press lightly on the speculum; the pressure being about one pound for every circular superficial foot. The motions of this machine are relatively so adjusted that the focal length of the speculum during the polishing process, or towards the lateral end of it, shall be gradually becoming slightly longer, and the figure will depend in a great measure upon the rapidity with which this increase in the focal length takes place. It will be evident that a surface, spherical originally, will cease to be so, if, while subjected to the action of the polisher, it is in a continual state of transition from a shorter to a longer focus; in fact, during no instant of time will it be actually spherical, but some curve, differing a little from the sphere, and which may be made to approach the parabola, provided it be possible in practice to give effect to certain conditions. An immense number of experiments, where the results were carefully registered, eventually established an empirical formula, which affords at present very good practical results, and may hereafter, perhaps, be considerably improved. In fact, when the stroke of the first eccentric is one third the diameter of the speculum, and that of the second eccentric is such as to

produce a lateral motion of the bar which moves the polisher, measured on the edge of the tank equal to ·27, the diameter of the speculum, or referred to the centre of the polisher, of 1·7, the figure will be nearly parabolic. The velocity and direction of the motions which produce the necessary friction, being adjusted in due proportion by the arrangements of the machine, and the temperature of the speculum being kept uniform by the water in which it is immersed, there remain still other conditions, which are essential to the production of the required result. The process of polishing differs very essentially from that of grinding: in the latter, the powder employed runs loose between two hard surfaces, and may produce scratches possibly equal in depth to the size of the particles: in the polishing process the case is very different; there the particles of the powder lodge in the comparatively soft material of which the surface of the polishing tool is formed, and as the portions projecting may bear a very small proportion to the size of the particles themselves, the scratches necessarily will be diminished in the same proportion. The particles are forced thus to imbed themselves, in consequence of the extreme accuracy of contact between the surface of the polisher and the speculum. But as soon as this accurate contact ceases, the polishing process becomes but fine grinding. It is absolutely necessary, therefore, to secure this accuracy of contact during the whole process. If the surface of a polisher, of considerable dimensions, is covered with a thin coat of pitch, of sufficient hardness to polish a true surface, however accurately it may fit the speculum, it will very soon cease to do so, and the operation will fail. The reason is this, that particles of the polishing powder and abraded matter will collect in one place more than another, and as the pitch is not elastic, close contact throughout the surfaces will cease. By employing a coat of pitch, thicker in proportion as the diameter of the speculum is greater, there will be room for lateral expansion, and the prominence can therefore subside, and accurate contact still continue; however, accuracy of figure is thus, to a considerable extent, sacrificed. By thoroughly grooving a surface of pitch, provision may be made for lateral expansion contiguous to the spot where the undue collection of polishing powder may have taken place. But in practice such grooves are inconvenient, being constantly liable to fill up; this evil is entirely obviated by grooving the polisher itself, and the smaller the portions of continuous surface, the thinner may be the stratum of pitch.

"There is another condition, which is also important, that the pitchy surface should be so hard as not to yield and abrade the softer portions of the metal faster than the harder. When the pitchy surface is unduly soft, this defect is carried so far that even the structure of the metal is made apparent. While, therefore, it is essential that the surface in contact with the speculum should be as hard as possible, consistent with its retaining the polishing powder, it is proper that there should be a yielding where necessary, or contact would not be preserved. Both conditions can be satisfied by forming the surface of two layers of resinous matter of different degrees of hardness; the first may be of common pitch, adjusted to the proper consistence by the addition of spirits of turpentine, or rosin; and the other I prefer making of rosin, spirits of turpentine, and wheat flour, as hard as possible, consistent with its holding the polishing powder. The thickness of each layer need not be more than one-fortieth of an inch, provided no portion of continuous surface exceeds half an inch in diameter, the hard resinous compound, after it has been thoroughly fused, can be reduced to powder, and thus easily applied to the polisher, and incorporated with the subjacent layer, by instantaneous exposure to flame. A speculum of three feet diameter thus polished, has resolved several of the nebulæ, and in a considerable proportion of the others has shown new stars, or some other new feature."

In conclusion, Lord Rosse exhibited drawings of the nebulæ, as figured by Herschel, and also as they appeared in the telescope constructed by his Lordship.

Fig. 88 of Herschel, or 2 Messier, and 21 h. 25 m. δ—1° 34′ south, many of the stars into which it is reduced by his telescope, are as large as those of the first magnitude to the naked eye.

Fig. 81, Herschel, the bright nebula near ζ Tauri, figured by Herschel as perfectly elliptic and resolvable, but no stars seen, is seen in the telescope, with 3 feet aperture, as a rather oval cluster of stars, with projecting filaments of stars; some of these filaments extending considerably, so as to give something of the idea of a scorpion.

Fig. 29 of Herschel. The ring nebula of Lyra, shows in the 3 feet telescope, seven stars, one triple. It is an annular cluster, with fringes, and the nebulous-looking centre in patches.

Fig. 45 of Herschel, a planetary nebula, is also seen as an annular cluster.

Fig. 26 of Herschel, the "Dumbell Nebula," is seen as an irregular cluster, or rather two in juxta-position, and nothing of the exact elliptic termination of Herschel's figure.

The late Dr. Dalton.

(From the Address of the President, the Dean of Ely.)

Dr. Dalton was one of that vigorous race of Cumberland yeomen amongst whom are sometimes found the most simple and primitive habits and manners combined with no inconsiderable literary or scientific attainments. From teaching a school as a boy in his native village of Eaglesfield, near Cockermouth, we find him at a subsequent period similarly engaged at Kendal, where he had the society and assistance of Gough, the blind philosopher and a man of very remarkable powers, and of other persons of congenial tastes with his own. In 1793, when in his 23rd year, he became Professor of Mathematics and Natural Philosophy in the New College in Mosley-street, Manchester, a situation which he continued to hold for a period of six years, and until the establishment was removed to this city, when he became a private teacher of the same subjects, occupying for the purposes of study and instruction the lower rooms of the Literary and Philosophical Society in George-street, rarely quitting the scene of his tranquil and unambitious labours, beyond an annual visit to his native mountains, with a joint view to health and meteorological observations. He made his first appearance as an author in a volume of "Meteorological Observations and Essays," which he published in 1793, and which contains the germ of many of his subsequent speculations and discoveries; and his first views of the Atomic Theory, which must for ever render his name memorable as one of the great founders of chemical philosophy, were suggested to him during his examination of olefiant gas and carburetted hydrogen gas. His theory was noticed in lectures which he delivered at Manchester in 1803 and 1804, and much more explicitly in lectures delivered at Edinburgh and Glasgow; it was, however, first made generally known to the world in Dr. Thomson's Chemistry in 1807, and was briefly noticed in his own system of chemistry which appeared in the following year; and though his claims to this great generalization were subject to some disputes both at home and abroad, yet in a very short time both the doctrine and its author were acknowledged and recognized by Wollaston, Davy, Berzelius, and all the great chemists in Europe. But the atomic theory is not the only great contribution to chemical science which we owe to Dalton; he discovered contemporaneously with Gay Lussac, with whom many of his researches ran parallel, the important general law of the expansion of gases—that for equal increments of temperature, all gases expand by the same portion of their bulk, being about three-eighths in proceeding from the temperatures of freezing and boiling water. His contributions to meteorology were also of the most important kind. Dr. Dalton was not a man of what are commonly called brilliant talents, but of singularly clear understanding and plain practical good sense; his approaches to the formation of his theories were slow and deliberate, where every step of his induction was made the object of long-continued and persevering thought; but his convictions were based upon the true principles of inductive philosophy, and when once formed, were boldly advanced and steadily maintained. It is always unsafe, and perhaps unwise, to speculate upon the amount of good fortune which is connected with the time and circumstances of any great discovery, with some view to detract from the credit of its author; and it has been contended that Wollaston, Berzelius, and others, were already in the track which would naturally lead to this great generalization; but it has been frequently and justly remarked, that if philosophy be a lottery, those only who play well are ever observed to draw its prizes.

"Though Dalton's great discovery," says the historian of the Inductive Sciences, "was soon generally employed, and universally spoken of with admiration, it did not bring to him anything but barren praise, and he continued in his humble employment when his fame had filled Europe and his name become a household word in the laboratory. After some years he was appointed a corresponding member of the Institute of France, which may be considered as a European recognition of the importance of what he had done; and in 1826, two medals for the encouragement of science having been placed at the disposal of the Royal Society by the King, one of them was assigned to Dalton, 'for his development of the atomic theory.' In 1833, at the meeting of the British Association for the Advancement of Science, which was held at Cambridge, it was announced that the King had bestowed upon him a pension of 150*l.*; at the preceding meeting at Oxford, that University had conferred the degree of Doctor of Laws, a step the more remarkable since he belonged to the sect of Quakers. At all the meetings of the British Association he has been present, and has always been surrounded with the reverence and admiration of all who feel any sympathy with the progress of science. May he long remain among us, thus to remind us of the vast advance which chemistry owes to him." This was written in 1837, the year in which a severe attack of paralysis seriously impaired his powers. He last appeared among us at Manchester, when he received the respectful homage of the distinguished foreigners and

others who were there assembled; he died on the 27th of July last, in the 78th year of his age. His funeral, which was public, was attended by all classes of the inhabitants, who felt justly proud of being the fellow-citizens of so distinguished a man.

The late Mr. Francis Baily.

(From the same.)

Mr. Baily was, undoubtedly, one of the most remarkable men of his time. It was only in 1825, that he retired from the Stock Exchange, with an ample fortune, and with a high character for integrity and liberality; but his subsequent career almost entirely belongs to astronomy, and is one of almost unexampled activity and usefulness. The Astronomical Society was organized by him, and throughout life he was the most considerable contributor to its Memoirs. The catalogue of the Astronomical Society, the funds for which were contributed by several of its members, was entirely formed under his superintendence, and we are chiefly indebted to his exertions for the more ample development which the Nautical Almanac has latterly received, and which has added so much to its usefulness. There was no experimental research connected with more accurate determinations of astronomy or physical science, which was not generally intrusted to his care; the publication of the Pendulum Observations of Captain Foster, which were confided to him by the Admiralty, gave occasion to the most complete series of pendulum experiments which had ever been made, in which many most important defects of those instruments were first brought to light: he undertook the repetition of the celebrated experiment of Mr. Cavendish, and his discussion of the whole question, which forms a recent volume of "The Memoirs of the Astronomical Society," is a monument not less honourable to his patience, perseverance, and skill, than to the sagacity and accuracy of the great philosopher who first devised it. He had also undertaken, for the Commission of Weights and Measures, the conduct of the process for forming the new standard yard from the scale of the Astronomical Society, which he had himself compared with the imperial standard yard, destroyed in the burning of the Houses of Parliament. He published, at the request of the Admiralty, the correspondence and catalogue of Flamsteed; he presented to the Astronomical Society, a volume containing the catalogues of Ptolemy, Ulugh Beigh, Tycho Brahe, Hevelius, and Halley, with learned prefaces and critical notes, showing their relations to each other and to later catalogues. His preface and introduction to the British Association Catalogue, and more than one-third of the catalogue itself, are printed; and from the critical examination of the authorities upon which his assumed positions rest, and from the careful distribution of the stars which are selected (more than 8000 in number) in those parts of the heavens where they are likely to be most useful to observers as points of comparison, it promises to be the most important contribution to the cause of practical astronomy, which has been made in later times. The whole of the stars of the Histoire Céleste are reduced, and a considerable portion (more than one-fifth) printed, but is not known whether the introductory matter which, from him, would have been so important, was prepared at the time of his death. Mr. Baily was the author of the best Treatise on Life Annuities and Insurances which has yet appeared, as well as of several other publications on the same subject. His knowledge of the mathematicians of the English school was very sound and complete, though he had never mastered the more refined resources of modern analysis. In the discussion of the Cavendish and other experiments, he freely availed himself of the assistance of the Astronomer Royal and Mr. De Morgan, in the investigation of formulæ which were above his reach; but he always applied them in a manner which showed that he thoroughly understood their principle, and was fully able to incorporate them with his own researches. In the midst of these various labours, (and the list, which I have given of them, ample as it is, comprehends but a small part of their number), Mr. Baily never seemed to be particularly busy or occupied: he entered freely into society, entertaining his scientific as well as mercantile friends at his own house with great hospitality. He was rarely absent from the numerous scientific meetings of committees and councils—he was a member of all of them—which absorb so large a portion of the disposable leisure of men of science in London: but if a work or inquiry was referred to him, it was generally completed in a time which would seem hardly sufficient for other men to make the preliminary investigation. Most of this was undoubtedly owing to his admirable habits of system and order: to his always doing one thing at one time: to his clear and precise estimate of the extent of his own powers. Though he always wrote clearly and well, he never wrote ambitiously: and though he almost always accomplished what he undertook, he never affected to execute, or to appear to execute, what was beyond his powers. This was the true secret of his great success, and of his wonderful fertility; and it would be difficult to refer to a more instructive example of what may be effected by practical good sense, systematic order, and steady perseverance.—(*To be continued.*)

THE ARGAND FURNACE—MR. DIRCKS IN REPLY TO "IGNIS."

Sir,—My letter of the 30th July appears to have had a slow but pungent effect on your fiery correspondent "Ignis," who, in his reply of September 16, seems at a loss how to evaporate his wrath with becoming dignity. He has no "intention of getting into a controversy with Mr. Dircks;" yet writes two pages of abusive misrepresentation—the best course to adopt for exciting a controversy. He has "no wish to deprive Mr. Williams of any of the merit which justly belongs to him," and yet, in four columns of most calumnious, unsupported, and false assertions, he directly charges Mr. Williams with plagiarism; with writing "until his inventions and discoveries nauseate by repetition;" and with such ignorance of the subject of combustion, that his treatise "is mischievous, on account of its imperfect and superficial statements." Verily, after this plucking, Mr. Williams has little to hope for in the way of any award for "merit" from your correspondent; he certainly has not yet given him any; nevertheless he is very indignant with my charge of his *defaming* Mr. Williams; and, stung by the justness of my remark, he has been at great pains to concentrate his little powers of wit in a sentence so hurtful to him, in hopes, no doubt, to prove by ridicule what he had no other means to support. If "Ignis" would write with any show of good feeling; with moderate scientific ability; or, wanting these, would cast his shafts, not anonymously, but with his proper name appended to his epistles, I should have pleasure in meeting him on equal ground. I have already found arguments against his first-published statements; if, however, he is so young in science, that he has yet to be schooled in chemistry, I may pity his ignorance, but must be excused becoming his teacher.

"Ignis" need not to have said he was "writing upon a subject upon which he took very little interest." Your readers cannot be so stultified but they must have clearly perceived this, both in his present and former communications. If he had taken *much interest* in it, or even understood it chemically, he could scarcely have written such an untruth as to state, that I had made the assertion, "that *carbonic oxide* is the only gas given off by timber when burnt." I not only never said so, but never discussed the subject, nor even hinted at gas of any kind as the gas peculiar to *burnt timber*. The kind of *interest* he takes in the subject is evident when he says, "I repeat, perfect combustion of coal in furnaces is a humbug!" and again, "the Smoke Nuisance Bill, if ever passed, and enforced," will, according to this sage, be "an infinitely worse nuisance to the manufacturers than ever the smoke itself was!" The "very little interest" taken in the subject, or rather the little understanding he has of it, is established by his statement, "I have said, 'Virlet clearly recognises the principle of *dividing* the streams of *mixing* air and gases,' and I repeat it." Be it so. Now comes the grand question at issue. Mr. Williams does *not* in his writings, or in his patent, recognise this *principle;* ergo, the *principle* recognised by M. Virlet, and the *principle* recognised by Mr. Williams, are materially different. But, as I cannot prove a negative, I call again on "Ignis" to point to any passage of Mr. Williams's writings falsifying this statement.

After all his pains-taking, the merit he labours so zealously to give M. Virlet, amounts in reality only to that of having been the first to invent a *humbug* furnace! one for perfect combustion, which he emphatically declares "*is* a humbug!" The eccentricities of your correspondent, throughout his communication, are very whimsically displayed in "sound and fury, signifying nothing." Only that his letter bears internal evidence of his dabbling in furnaces, and having the dangerous "little knowledge" which gives only a smattering of science, and even more of this than might be expected from one taking "little interest" in the subject, I could better than I now can, apologize for his ardent desire to place (at all risks and all hazards) the invention of the argand furnace to the credit of the French engineer, rather than to the "nauseous" Englishman, whom he so vigorously defames. Here, indeed, is a very Daniel come to judgment, ignorant though he be of chemistry, and "very little the interest" he takes in the subject generally! If your correspondent is unmoved by the meanness of personal motives, whether directly or indirectly, I advise him to drop this masquerading, or write with more judgment and better feeling.

I am your obedient servant,

H. Dircks.

77, King William-street, City,
October 4, 1844.

THE THAMES STEAMERS.

Sir,—I have been anxiously looking for the proof which Mr. Cormack said it was his intention to furnish, that my opinion of the power of the *Meteor* was erroneous; I conclude from his delaying so long that he has changed his mind upon the subject. Since I wrote my last letter, consi-

derable changes have taken place among the fast steamers, which I shall now briefly notice. A great increase was produced in the speed of the *Eclipse*, by her being lengthened and supplied with a new boiler, an operation which has been performed on a great many boats lately, and always with a beneficial result. With the *Eclipse* its success was so great as to render her much faster than any other boat on the River, a rank which she still retains; for although she was beaten by the *Wonder* in a trial preceding that described in your last Number, that boat has now departed for her station in the Channel. There has been a slight decrease in the speed of the *Meteor*, probably occasioned by her engines not being now in the very perfect working order for which they were remarkable in an earlier part of the season. The *Wonder*, which having beaten the *Eclipse*, must now be considered the fastest boat in England, easily passed the *Sapphire*, *Isle of Thanet*, *Prince of Wales*, *Ruby*, *Meteor*, *Vesper*, *Railway*, and all the other fast boats. The success of this boat shows that the prejudices against atmospheric engines, which were once so common, and which many persons retained even after the *Sapphire* had been running, were entirely groundless. I am, Sir, &c.

CURVE.

THE "PIGMY GIANT" AND HODGSON'S PARABOLIC PROPELLER.

Sir,—In your last Number, there is an account of an experimental trial of a new propeller patented by Mr. Hodgson, which has, I think, obtained an extremely favourable result; but the information would have been still more valuable, had it included the correct pressure in the boiler, the vacuum, and the number of revolutions per minute both of the engine and of the propeller. With such data, we should have been able to compare the performances of this propeller with those of another, of which I subjoin an account, both propellers having been tried in the same vessel.

I find upon referring to memoranda of the vessel in which this trial took place, that the *Pigmy Giant* is truly what her name betokens. The following particulars respecting her will render your correspondent "K. R.'s" communication in No. 1056 more perfect, and by these your engineering correspondents will perceive that this little vessel, which is only 38 ft. long, and 8 feet 6 inches beam, with a mean draught not exceeding 25 inches, and an immersed midship section of only 9 feet, has a calculated and *acknowledged actual power*, when working at *only* 40 pounds pressure, with the vacuum gauge at 25 inches, and making 225 revolutions per minute, of 18·69 horses. I may fearlessly ask where is there another vessel so small in size, fitted with such *giant* power, to obtain the necessary quantity of steam? She is fitted with one of Beale's patent boilers, 3 feet in diameter, and 5 feet high, containing 290 half-inch tubes placed vertically, and 3 feet 3 inches long; fire surfaces in fire-box and tubes = 111 square feet, which gives nearly $5\frac{1}{3}$ square feet to each horse power. The fire is urged by a fan 22 inches in diameter, and 5 inches wide, driven by a cord passing over a pulley upon the axle of the engines, which makes nearly 1,200 revolutions per minute. When fitted with a propeller in imitation of Blaxland's, consisting of 4 segments of a screw placed on 4 arms extending from the boss, being 2 feet $1\frac{1}{2}$ inch in diameter, and 4 feet pitch with a propelling surface = $\frac{2}{9}$th of midship section of boat, and the propeller making 295 revolutions per minute = 13·25 miles per hour, the actual speed of the boat through the water was 10 miles per hour, leaving a slip of 3·25 miles per hour.

I would respectfully submit, that all trials of steam-boats on the Thames should be taken at *the measured mile* in Long Reach; a plan invariably adopted by the Government, since there are *miles* on the Thames which, owing to the curvature of the river, are not correct, and also places which, at particular times of the tide, ebb more rapidly than at others. Possibly this may account for the difference of speed in the trial of Mr. Hodgson's propeller, for one mile, as there stated, exceeded the other in time by 1′ 50″, or nearly 50 per cent. I am, &c.,

INQUISITIVUS.

Blackwall, October 8, 1844.

Rowan's Patent Axles.—(See *Mechanics' Magazine*, last Vol., p. 385.)—The Birmingham and Gloucester Company recently sent their engineer, Mr. McConnell over to Ireland, to have ocular inspection of the working of the Patent Anti-friction Axles of Messrs. Rowan and Co., which have been for some time in experimental use on the Ulster Railway; and in consequence of his favourable report of them, they have ordered fifty of their wagons to be supplied with these axles forthwith. The axles of the trial wagon on the Ulster line, which had travelled upwards of 3,000 miles, with an average load of four tons, were found, on examination, as smooth, and in as perfect order, as on the day they were first started, though they had never all the time been cleaned, and but once oiled. —*Railway Record.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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EAST INDIAN SUSPENSION BRIDGE.

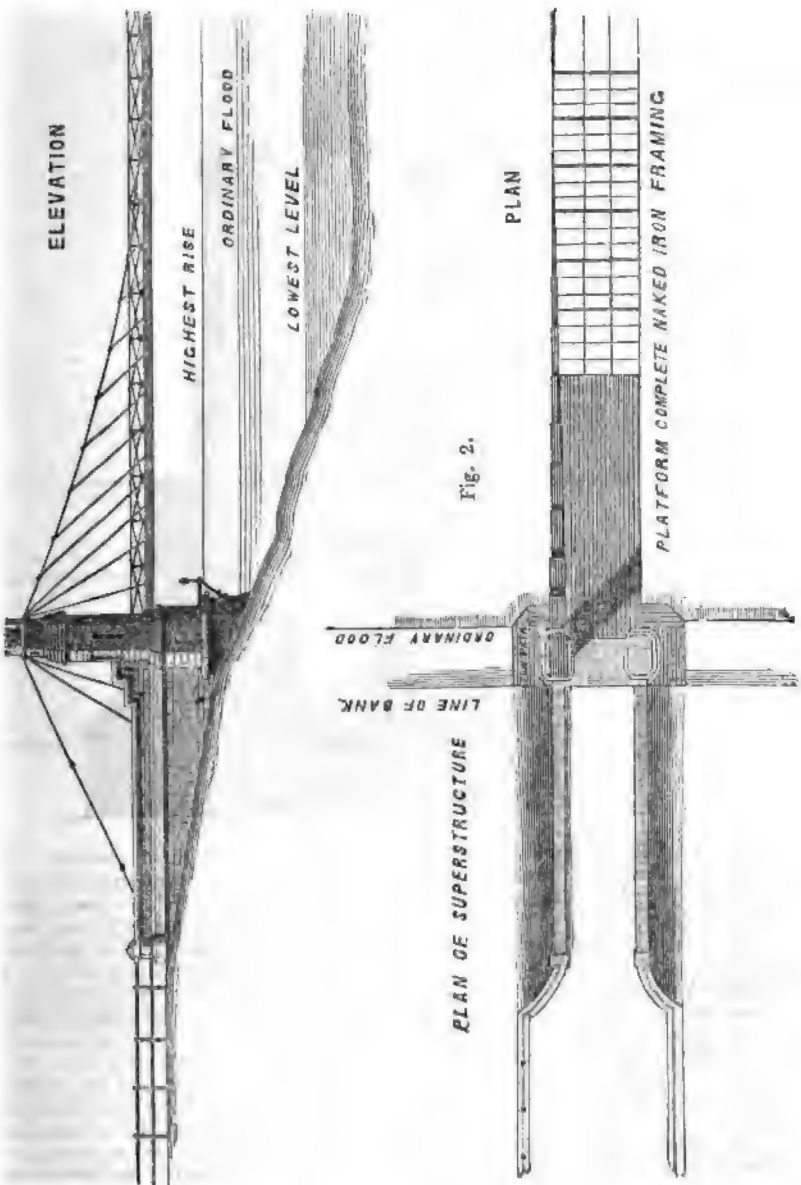


Fig. 1.

Fig. 2.

DESCRIPTION OF A SUSPENSION BRIDGE ON MR. DREDGE'S PRINCIPLE, ERECTED OVER THE BALLEE KHAL, FOR THE INDIAN GOVERNMENT, FROM THE DESIGNS, AND UNDER THE SUPERINTENDANCE OF CAPTAIN GOODWYN, R. B. E.

Fig. 5.

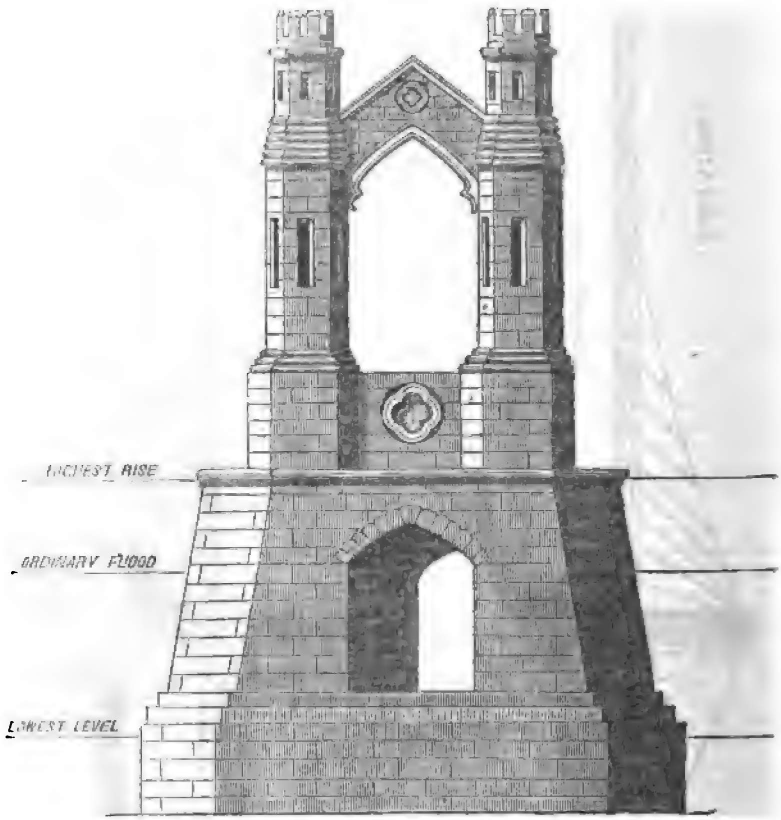


FIG. 1 of the accompanying engravings is an elevation of one-half of this bridge, and fig. 2, a plan of one-half of the superstructure.

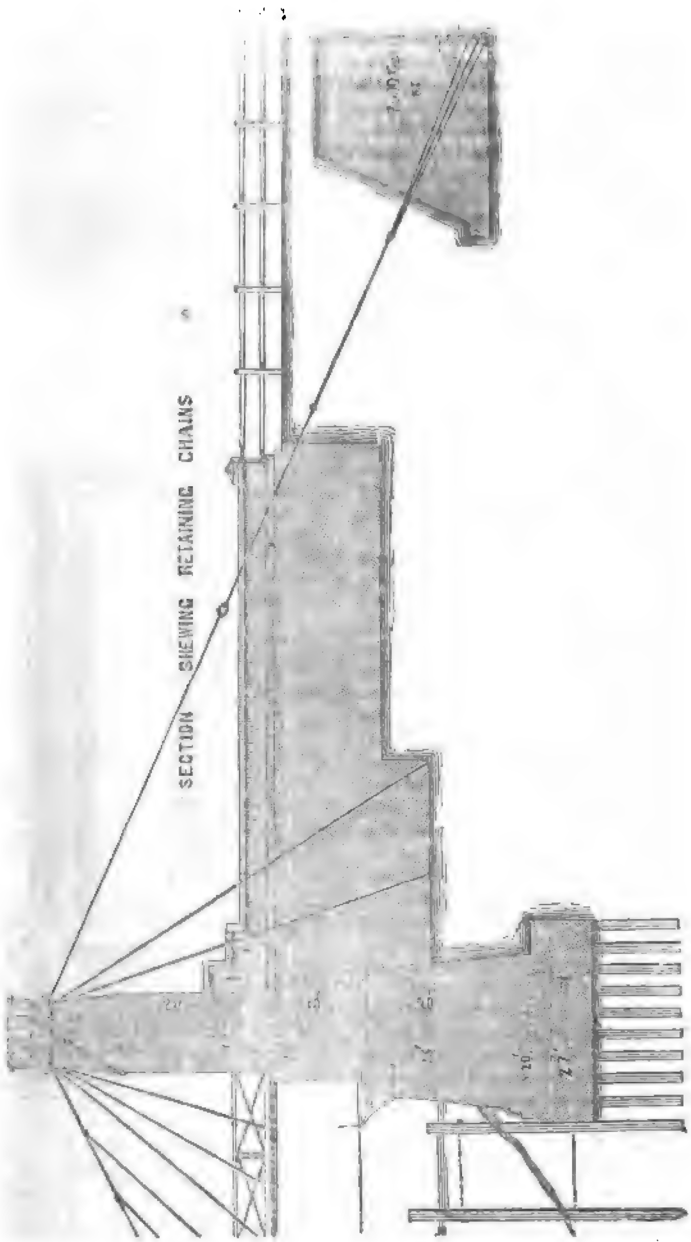
Fig. 3 is an elevation in section of the principal parts of the other half of the bridge, showing the manner in which the chains are secured.

Fig. 4 is a plan of the foundations of the parts represented in fig. 3.

Fig. 5 is a transverse elevation of the one of the piers on a larger scale than in fig. 1.

The Ballee Khâl is about four miles north-west of Calcutta. The bridge consists of a single curve of 250 feet span, with 18 feet width of platform. The height of the points of suspension above the plank level, which is equal to the deflection of the chains, is 26 feet, or $\frac{1}{9.61}$ the chord line nearly. The angle of suspension, is therefore about 19° 51′. The platform is supported by two main chains, one on each side of the bridge, composed of links of round bar iron $1\frac{5}{8}$ inch in diameter, and 10 feet long; there are 15 of these links resting on the towers at each point of suspension, and from thence at each joint the number is lessened one link, till at the centre the sectional area of the chain is reduced to two bars $\frac{7}{8}$th inch in diameter. The oblique suspending

Fig. 3.



rods depend from the chains at each joint in pairs; they are ¼th of an inch in diameter, and the angles at which they are attached to the platform vary from 67°42′, to 10°, becoming more and more acute as they approach nearer the centre of the bridge. There are three pairs of these suspending rods at each point of suspension, which support 23 feet of the roadway at each end of the bridge, taking the weight thereof immediately to the tower link, without effecting the curve of the chains. Thus, $250-23\times 2=204$ feet = the length of platform supported by the chains.

Now the tension at the points of suspension is equal to half weight (of bridge and traffic jointly taken at 128 lbs. per square foot) × cosecant of angle of suspension, or $\frac{197}{2}$ $2\cdot 94=289\cdot 6$ tons tension, for which 45 square inches of iron is allowed, and as the strain to which each bar was subjected before erection was 10 tons per square inch, there is a strength of iron sufficient to resist 450 tons.

The angle of the first auxiliary from the chain is double that of the first chain link, and the common difference of the whole series, is about double that of the difference between any two consecutive links of the chain. The pull on the rods is thus as nearly as possible in the direction of their length, and the horizontal force is resisted through the horizontal line of the platform. The angle formed by the last link of the chain, and the horizontal, or central one, is 5°, and that of the centre auxiliary 10°, so that the last link bisects the angle formed by the centre link, and centre auxiliary, and as these forces are nearly equal, the last link is in the best possible position for preserving the equilibrium at the junction, and not allowing the centre link to be strained beyond its power.

The back chain forms a continued line from the rear bolt of the tower links at an angle of 25°, the section of iron being the same throughout as that of the tower links. The mass of masonry to which the chains are secured contains 7,0C0 cubic feet, which, with the completion of the parallelogram from the point where the back chains meet the road level, gives nearly 19,000 feet of resisting matter on each side, or about double what is due to the most severe tension.

Between the 2nd and 3rd links of the back chains are a series of adjusting loops and eyes, similar to those of the Menai Bridge, admitting of 4 inches correction.

Fig. 4.

Two back stays depend from the end

of the rear tower bolts, and are together in power equal to the three pairs of auxiliaries, to complete the connexion between which and the back stays, bars are introduced or added to the tower links, coupling in with the oblique rods, front, and rear, and equalizing the bearing on the tower link bolts.

These stays are keyed behind cast plates abutting against stone at the base of the wing walls, and tend to assist in the support of the towers, as well as to counteract the effect of any violent pull on the tower links by a sudden weight impinging on the platform.

The level of the platform is 18 feet above the ordinary, and 10 feet above extreme flood rise, and is composed of two external longitudinal beams 5 in. by ⅝ in., to which are attached, by means of cast boxes, the transverse beams of T-iron (4 in. by ½ in. web), and (3 in. by ⅝ in. table) every third of which is trussed with a central rod of 1 in. diameter, and 4 rods of ¾ in. diameter. Through the cast trusses, or boxes, in which these rods are connected, pass two internal longitudinal beams, 4 in. by ⅝ in., supporting the untrussed transverse beams, and reducing their length between the bearing points.

The planks are 3½ in. thick, teak timber, spiked down to the table of T-iron, and protected by metalling of Kunker, 4 in. thick.

Capt. Goodwyn, in a letter to Mr. Dredge, dated July last, observes, "With the assistance of a very able and first-rate mathematician here, I have studied the theory of these bridges most thoroughly; and the model that I have made, 22 feet long, and 4 feet width of platform, is on so large a scale, that I have been able to test it in every possible way, and it has withstood the utmost efforts to derange its parts. The Governor-General, and all the scientific people here, have perfectly satisfied themselves of the efficiency of the system, and all these proofs, with my models, assure me that the theory is correct."

It is in contemplation to erect immediately two other bridges on the same plan, one across the wet docks at Kudderpoor, near Calcutta, and the other over the Hoogly.

WARMING AND VENTILATION—MR. COXWORTHY IN REPLY TO "NN. L."

Sir,—I must confess, with reference to "N. N. L.'s" letter in your No. 1104, that I was i norant of the existence of Dr. Jeffrey's grate, until I read a description of it in Mr. Hood's work on ventilation, nor can I see, after a reference to the *Mechanics' Magazine* of March, 1839, what similarity there is between it, with its air box and tubes, and my stove, beyond the introduction of warm air into the apartment, instead of allowing the whole to find its way into the room, as it does with the ordinary stoves, through the doors and windows; and I beg to assure your correspondent that turning the heat of the kitchen chimney to account had not escaped my attention; but it is to be observed that every proper kitchen grate has its boiler and oven, which entirely surround the back and sides of the fire, and that to admit of vessels being readily put on, and taken off the fire, the opening in the chimney must necessarily be large; and as the rate of combustion and temperature of the flue are governed by the amount of opening in the fireplace, it appears to me that the throwing of any more cold air into the flue, or in any other way reducing the temperature of the smoke, would infallibly arrest its ascent, to say nothing of counter currents.

Unless powerful extraneous means be available, such as the large chimney used by Dr. Read for the Houses of Parliament, or a fan worked by mechanical power, I am clearly of opinion that every room occupied by human beings must have its own warming and ventilating apparatus during cold weather, and the question, therefore, is, how the object is best to be attained, with regard both to efficiency and economy? Close stoves, in my opinion, will never answer, whether with or without a casing, in this variable climate; for they must afford either an excess of heat, or a deficiency of ventilation; but it appears to me that as the rate of combustion and amount of ventilation are governed by the amount of opening above the fire, that the space may be so adjusted by experiment as to make the one dependent on the other—regard being of course had to the length of the flue, a point very little attended to at present, the opening on the first floor

being frequently greater than that on the ground floor, although the flue must obviously be several feet shorter, and, therefore, the draft less in proportion. A proper adjustment of the opening of the chimney will assuredly remove all possibility of the back of the grate ever becoming sufficiently heated to "*burn the air*" as it passes over it.

The first question, however, to be decided is, whether the products of respiration are subject to a law of diffusion,—the existence of which law, apart from chemical affinity, I doubt,—or whether the carbonic acid is, as I suspect, subservient to that of gravitation. And as the former opinion is entertained by almost all the scientific men of the day, I have determined on putting the matter at rest by making a correct analysis of the atmosphere of the theatre of the London Mechanics' Institution, and thereby deciding whether or not, as stated by Mr. Ritchie, Dr. Ure is correct, and that the downward circulation of air, having reference to the products of respiration, is a noxious fallacy.

For this purpose I have had made a bottle 2¼ inches diameter, by 12 inches deep, to the neck of which is fixed a cap having a stop-cock in the centre, and small glass tubes all round, which descend nearly to the bottom of the bottle. Now it is evident that, as air is drawn off through the stop-cock by means of an exhausting syringe at the rate of a certain number of strokes per minute, a corresponding quantity of air will pass down through the tubes, and will ascend through any menstruum the bottle may contain, and that if this liquid contain a substance that has an affinity for carbonic acid it will rob the air of it in its ascent. I propose, then, first to determine the amount of baryta that will be precipitated in the open air by the passage of a certain quantity through a solution of it, and then to ascertain the quantity that will be precipitated in different parts of the theatre. Now it is evident, I think, that if the carbonic acid generated by respiration ascends, a greater quantity of it will be appreciable in the upper gallery and ventilator at the top of the building, than in the pit; whereas, if, as I suspect, the greater part of that gas passes off by condensation, its presence will be most manifest in the pit. I shall, of course, have regard to the number of persons in the theatre at each experiment. This will necessarily take some little time to perform; and if any gentleman, who entertains different opinions to myself on this truly important question, should feel desirous of joining me in the experiment, I shall feel great pleasure in informing him when I intend to commence operations. I remain, Sir, yours, &c.

F. COXWORTHY.

SUGGESTIONS FOR A NEW APPARATUS TO PREVENT ACCIDENTS IN COAL MINES.

Sir,—The horrible accident which has lately destroyed so many labourers at Haswell Colliery, in despite of safety lamps and excellent ventilation, calls on every thinking man to consider whether some mode of protection cannot be devised whereby light without fire might be introduced, and this independently of any care or attention on the part of the workman. I think this might be accomplished by means of reflectors and lenses, so placed as to communicate with each other; for we know that light is transfusible by its own activity, and that it is difficult to make any place completely dark that has once been flooded with its rays. Suppose an apparatus like the Bude light were placed at the bottom of a shaft, would it not be possible, by means of lenses and mirrors, made movable by ball and socket joints, to conduct the light through every angle of the workings, so as to be expanded or contracted as occasion might demand, and fitted to every angle required? I am aware that such a mode of lighting would be attended with no small expense; but when we consider that the object is the saving of the lives of numerous poor labourers, from whose exertions the public derive so much comfort and wealth, I trust that the owners of our collieries will not allow such a consideration to interfere with their sense of justice and humanity.

I remain, Sir,
Your obliged servant,
GEO. CUMBERLAND, SEN.

Bristol, Oct. 9, 1844.

[The same mode of illuminating coal mines was long ago suggested by the inventor of the Bude light himself, Mr. Goldsworthy Gurney.—ED. M. M.]

PROBLEMS ON STEAM POWER. BY MR. THOMAS TATE, MATHEMATICAL MASTER OF THE NORMAL SCHOOL, BATTERSEA.

[Concluded from page 444, vol. xl.]

Hitherto the investigations have been conducted on purely algebraic principles, but in discussing the following interesting problems, it will be necessary to call in the aid of the integral calculus.

36. To find the relation between the space and velocity of a locomotive, after the steam has been turned off, taking the resistance of the air into account.

By differentiating equation (47) page 72, of Moseley's Mechanical Principles of Engineering, we find,

$$d\,S = \frac{W}{g} \cdot \frac{V\,d\,V}{P} \ldots (1);$$

where V is the velocity, in feet, per second, corresponding to the space s feet (estimated from the point at which the steam is turned off,) and P the unbalanced, or moving pressure at that point.

$$\text{By eq. (1), 26, } R = T\,(r \pm 22{\cdot}4\,h) + \frac{g}{V_1^2} \cdot V^2 = a + b\,V^2.$$

In this case, the unbalanced pressure is an opposing force, and therefore it must be taken minus in the general expression (1),

$$\therefore d\,S = -\frac{W}{g} \cdot \frac{V\,d\,V}{a + bV^2}.$$

Integrating between the limits v and V, we have,

$$S = \frac{W}{2\,g\,b} \log. \frac{a + b\,v^2}{a + b\,V^2} \ldots (2).$$

In performing this integration, it will be observed, that when $S = o$, $V = v$.

When $V = o$, that is, when the train comes to a state of rest, the equation becomes,

$$S = \frac{W}{2\,g\,b} \log. \left(1 + \frac{b}{a} \cdot v^2\right) \ldots (3).$$

In order to obtain V in terms of S, let $\frac{W}{2\,g\,b} = \frac{1}{c}$; then, by the properties of logarithms, $e^{-c\,S} = \frac{a + b\,V^2}{a + b\,v^2}$, whence we readily find,

$$V = \left(\frac{(a + b\,v^2)\,e^{-c\,S}}{b} - \frac{a}{b}\right)^{\frac{1}{2}} \ldots (4).$$

Example 46. The weight of the train, in example 43, is 100 tons, it is required to determine the distance the train will move after the steam is turned off, assuming the resistance of the air to be the same as in example 28.

Here $a = 100\,(8 + 22{\cdot}5 \times {\cdot}5) = 1925$, $b = {\cdot}33$, $W = 224000$, and $v = 44$, therefore, by eq. (3),

$$S = \frac{224000}{2 \times 32 \times {\cdot}33} \log. \left(1 + \frac{{\cdot}33}{1925} \times 44^2\right) = 3024 \text{ feet nearly.}$$

Observation. Comparing this result with that of Example 43, it appears, that 500 feet are due to the resistance of the atmosphere.

37. To determine the relation between S and V, assuming the pressure upon the piston to be constant (as in the atmospheric locomotive).

Let R_1 be the total pressure of the elastic fluid referred to the circumference of the wheel, then, as the opposing pressure is given in eq. (2), 36, we have,

$P = R_1 - R \times R_1 - a - b\,V^2 = c - b\,V^2 \ldots (1)$, substituting this value of the accelerating pressure in eq. (1), 36, and integrating as before, we obtain,

$$S = \frac{W}{2\,g\,b} \log. \frac{c - b\,v^2}{c - b\,V^2} \ldots (2).$$

Here v is the velocity with which the engine starts. When the engine attains a maximum speed the accelerating force must be nothing, that is, we must have,

$c - b\,V^2 = 0$, or $V = \sqrt{\frac{c}{b}}$; but when this takes place, the denominator of the logarithm becomes nothing, and then $S = \infty$. Hence it appears that the train never does attain its maximum speed, as that can only take place when the space moved over is infinite.

Example 47. Through what space will the engine, in the last example, have to move in order to acquire the speed of 30 miles per hour, supposing the pressure of the elastic fluid upon the wheel to be 4,000 lbs., and that the engine starts with the velocity of 10 feet per second?

Here $c = 4000 - 1925 = 2075$, $b = \cdot 33$, $W = 224000$, $V = 44$, and $v = 10$; then, by eq. (2),

$$S = \frac{224000}{2 \times 32 \times \cdot 33} \log. \frac{2075 - 33}{2075 - 638 \cdot 8} = 3720 \text{ feet.}$$

38. To determine the relation of t and V, when the elastic fluid acts as in the last problem.

For this purpose we have the general equation,

$$P = \frac{W}{g} \cdot \frac{dV}{dt} \cdot$$

(Moseley's Mechanical Principles of Engineering, p. 94,) therefore by eq. (1), 37, we have,

$$c - bV^2 = \frac{W}{g} \cdot \frac{dV}{dt};$$

$$\therefore t = \frac{W}{g} \int_V^v \frac{dV}{c - bV^2} = \frac{W}{2gc^{\frac{1}{2}}b^{\frac{1}{2}}} \log. \frac{(c^{\frac{1}{2}} + b^{\frac{1}{2}}V)(c^{\frac{1}{2}} - b^{\frac{1}{2}}v)}{(c^{\frac{1}{2}} - b^{\frac{1}{2}}V)(c^{\frac{1}{2}} + b^{\frac{1}{2}}v)};$$

where v is the initial velocity, or what V becomes when $t = 0$.

When the engine attains its maximum speed, $V = \sqrt{\frac{c}{b}}$; but in this case, the factor $c^{\frac{1}{2}} - b^{\frac{1}{2}} V = 0$, and then the expression for t becomes infinite, thus confirming the deduction made in 37.

Example 48. In what time will the engine, in example 47, attain the speed of 30 miles per hour?

$$\text{Here, } t = \frac{224000}{64 \times \cdot 574 \times 45 \cdot 5} \log. \frac{(45 \cdot 5 + \cdot 574 \times 44)(45 \cdot 5 - \cdot 574 \times 10)}{(45 \cdot 5 - \cdot 574 \times 44)(45 \cdot 5 + \cdot 574 \times 10)} = 2 \cdot 2 \text{ minutes.}$$

39. To determine the relation between S and V, when the pressure of the steam in the cylinder is a given function of the velocity.

Let the total effective pressure of the steam upon the driving wheel be expressed by the equation $R_1 = f(V)$, then, by eq. (1), 37,

$$P = f(V) - a - bV^2;$$

$$\therefore S = \frac{W}{g} \int_V^v \frac{V\,dV}{f(V) - a - bV^2} \dots (1).$$

If, therefore, f V were known, the integration might be effected; but, independently of experiment, it is impossible to discover any exact analytical representation of this function; for, amongst other circumstances of less complexity, it evidently depends upon the variable discharge of the steam into the cylinder, arising from the unequable motion of the piston in each stroke, and the consequent change of temperature and density of the steam. If, however, the relation of the mean pressure and velocity were determined by experiment in three or more cases, the law of relation might be ascertained sufficiently near, for practical purposes, by the method of interpolation. In the absence of such data, an approximation to the truth will be obtained, by supposing the pressure to be inversely as the velocity, or, what is the same thing, by assuming the working power of the engine to remain constant. Proceeding on this hypothesis, let U be the work of the engine per second, then $R_1 \times V = U$; and $\therefore R_1$ or $f V = \frac{U}{V}$, substituting in equation (1),

$$S = \frac{W}{g} \int_V^v \frac{V^2\,dV}{U - aV - bV^3} \dots (2).$$

Integrating this expression, between the limits v and V, first when the resistance of the atmosphere is neglected, we find,

$$S = \frac{W}{ga} \left\{ \tfrac{1}{2}(v^2 - V^2) + \frac{U}{a}(v - V) + \frac{V^2}{a^2} \log. \frac{U - av}{U - aV} \right\} \dots \dots (3).$$

In order to integrate the general formula, it is necessary to observe that, since U, a, and b are essentially positive, when the engine ascends the incline, the expression in the denominator will have one positive and two imaginary roots, (see Hymer's Equations, p. 82.) Let e, therefore, be the real root, then,

$$S = \frac{W}{g} \int \frac{V^2\,dV}{U - aV - bV^3} + C = \frac{-W}{gb} \int \frac{V^2\,dV}{V^3 + \frac{a}{b}V - \frac{U}{b}} + C =$$

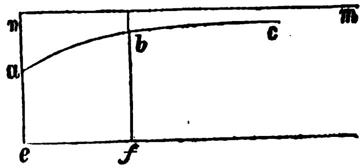
$$\frac{-W}{g\,b}\int\left\{\frac{D\,d\,V}{V-e}+\frac{(A\,V+B)\,d\,V}{(V-a)^2+\beta^2}\right\}+C=$$

$$\frac{W}{g\,b}\left\{D\log.\frac{v-e}{V-e}+\frac{A}{2}\log.\frac{(v-a)^2+\beta^2}{(V-a)^2+\beta^2}+\frac{A\,a+B}{\beta}\left(\tan.^{-1}\frac{v-a}{\beta}-\tan.^{-1}\frac{V-a}{\beta}\right)\right\}\ (4)$$

When the motion of the train becomes uniform, $V^3+\frac{a}{b}\,V-\frac{U}{b}=0$, the real root of which is e. By putting this value for V in the above expression, the term $\log.\frac{v-e}{V-e}$ becomes infinite. Hence it appears that the maximum speed of the engine cannot be attained until it has gone over an infinite distance.

Applying the same reasoning to equation (3) we have for the equation of uniform motion, or maximum speed, $V=\frac{U}{a}$, and for this case $S=\infty$. The assumption $f\,V=\frac{U}{V}$, upon which this remarkable result has been based, evidently gives the moving pressure rather below what in ordinary cases it really is; therefore, *à fortiori*, our locomotive engines never do attain their maximum speed. At the same time it is important to observe that our expression indicates that the speed undergoes but little increase after it has attained a certain limit. This analytical deduction will account for the discrepancies in the statements of two of our most distinguished engineers, Brunel and Stephenson, relative to this matter, the former making the distance at which the maximum speed is attained about 8 miles, the latter only about 4 miles.

The relation of speed and space may be represented by the approach of a



curve, *a b c*, towards its asymtote *n m*, where *b f* is the velocity corresponding to the space, *e f*, moved over, and *e n* the maximum speed; requiring the engine to move over an infinite distance to attain that speed, but showing at the same time that this maximum speed is *nearly* attained in a finite time.

Example 49. When will an engine of 60 horses power attain a speed of 30 feet per second, or about 20 miles per hour, the weight of the train being 50 tons, the resistance of friction 8 lbs. per ton, and the velocity of starting 10 feet per second?

In this case, $U=\frac{60\times33000}{60}=33000$; $v=10$; $V=30$; $a=50\times8=400$; $W=50\times2240$; $g=32$; then, by eq. (3),

$$S=\frac{50\times2240}{32\times400}\left\{\tfrac{1}{2}(10^2-30^2)+\frac{33000}{400}(10-30)+\frac{33000^2}{400^2}\log.1{\cdot}38\right\}=1240\text{ feet.}$$

Example 50. Through what space will the engine in the last example have to move in order to attain the speed of 70 feet per second, or 47 miles per hour?

$$\text{Here } S=\frac{35}{4}\left\{-2400-4950+6806{\cdot}25\times\log.5{\cdot}8\right\}=7{\cdot}6\text{ miles.}$$

Example 51. When will the engine in the last example attain the speed of 60 feet per second, or 41 miles per hour?

Proceeding as in the last example, we find, $S=3{\cdot}7$ miles.

40. To determine the relation between t and V, supposing the steam to act as in the preceding problem.

When the resistance of the atmosphere is neglected, we have $P=\frac{U}{V}-a$; therefore, by substitution in the general formula 38,

$$d\,t=\frac{W}{g}\cdot\frac{d\,V}{\frac{U}{V}-a}=\frac{W}{g}\cdot\frac{V\,d\,V}{U-a\,V}=\frac{W}{g}\left\{-\frac{d\,V}{a}+\frac{U}{a}\cdot\frac{d\,V}{U-a\,V}\right\}$$

Integrating between the limits of V and v,

$$t = \frac{W}{a g}\left\{v - V + \frac{U}{a} \log. \frac{U - a v}{U - a V}\right\}$$

and so on to the general case.

Here, again, we observe, that when the speed is a maximum the time is infinite.

Example 52. In what time will the engine, in Example 49, acquire the speed of 60 feet per second?

$$\text{Here, } t = \frac{50 \times 2240}{400 \times 32}\left\{10 - 60 + \frac{33000}{400} \log. 3 \cdot 22\right\} = 6 \cdot 7 \text{ minutes.}$$

41. Having introduced the use of a more recondite analysis, it may be interesting to apply the same method to the investigation of the Problems, 2, 7, and 8.

If l be the whole stroke, including the clearance c, U_1 the work done expansively at x feet of the stroke, corresponding to P_1 pressure of the steam, then by Moseley's Mechanical Principles, (page 55,)

$$U_1 = \int_x^h P_1 \, d x \ldots (1).$$

By the formula of relation between the volume and pressure of the steam, (page 102, vol. xl.)

$$P_1 = \frac{1}{\frac{x}{h}\left(\frac{1}{P} + \cdot 00268\right) - \cdot 00268} = \frac{1}{a x - b};$$

$$\text{where } a = \frac{1}{h}\left(\frac{1}{P} + \cdot 00268\right); \text{ and } b = \cdot 00268.$$

Substituting this value of P_1 in eq. (1), we have,

$$U_1 = \int_x^h \frac{d x}{a x - b} = \frac{1}{a} \log. \frac{a x - b}{a h - b} \ldots (2).$$

To determine x in terms of U_1, we find from the properties of logarithms,

$$e^{a U_1} = \frac{a x - b}{a h - b}, \quad \therefore x = \frac{1}{a}\left\{(a h - b) e^{a U_1} + b\right\} \ldots (3).$$

When $x = l$ in equation (2), the whole work in one stroke becomes,

$$K U \text{ or } L K (l - c) = K\left\{\frac{1}{a} \log. \frac{a l - b}{a h - b} + P(h - c) - p(l - c)\right\} \ldots (4).$$

Where L represents the sum of the pressures opposing the motion of the piston, as in eq. (A), 10.

When the work is required in terms of the water evaporated, the P, in this expression must be eliminated, by the expression given in 14.

Substituting the values of U_1 and U_2 in the expression given in 7, we find,

$$V = \left\{\frac{2 g K}{W}\left(\frac{1}{a} \log. \frac{a x - b}{a h - b} + P(h - c) - p(x - c) - L x\right)\right\}^{\frac{1}{2}} \ldots (5).$$

If R be put for the sum of all the resistances upon each inch of the piston, viz., $F + L_1 (1 + f) + p$, then the maximum velocity will take place when,

$$P_1 = R = \frac{1}{a x - b}; \text{ from which we find,}$$

$$x = \frac{1}{R a}(1 + b R) \ldots (6).$$

This is the expression for the position of the piston, when the maximum velocity takes place: it is more accurate than that given in 8, inasmuch, as Pole's formula gives the relation of the volume and pressure of the steam more accurately than Marriotte's law. It may not be improper here to observe, that the expression given for this point in the paragraph just referred to, neglects the pressure of the vapour in the condenser.

Example 52. Required the work performed upon 1 inch of the piston, in example 1.

Here $P = 28$, $l = 9$, $h = 3$, $c = 0$, $k = 1$, then by formula (4), $a = \frac{1}{3}\left(\frac{1}{28} + \cdot 00268\right) = \cdot 01279$,

$$b = \cdot 00268, \text{ and, } U = \frac{1}{\cdot 01279} \log. \frac{\cdot 01279 \times 9 - \cdot 00268}{\cdot 01279 \times 3 - \cdot 00268} + 28 \times 3 = 174.$$

It will be observed that this result nearly coincides with that obtained in example 1.

LONGMORE'S PATENT SELF-ADJUSTING SPHERICAL PENHOLDER.

(Patent sealed May 4, 1843; Specification enrolled November 3, 1843.)

The penholder is an instrument peculiar to the present century; Bramah's (*the original*) was for many years the only instrument of the kind in use. At length, however, the very general employment of steel pens directed the attention of ingenious men to the penholder as an instrument susceptible of great improvement. The present patentee was among the very first to make an inroad on the Bramah monopoly, and the superiority of the "Universal Penholder" became pretty generally admitted. On subsequent investigation, however, it occurred that even the best of modern penholders were constructed upon an erroneous principle, consisting as they did, of two jaws having an *angular* movement from a centre, which could not possibly take a fair hold of a body like a steel pen, having two *parallel* flat surfaces. All penholders previous to the introduction of the present invention, were made to hold the pen inserted between the jaws, at such an unfavourable point, that whatever the form or dimensions of the pen, it was held at a great mechanical disadvantage. If the pen was *small* there was a great want of firmness and stability, while a *very large* pen exhibited the same defects, together with a straining of the parts of the holder.

In order to meet these objections, Mr. Longmore has produced his "Patent Self-adjusting Spherical Penholder," as shown in the accompanying engravings, fig. 1 being an external representation of the holder, and fig. 2 a section of the same. It consists of a tube of silver or other metal, *a*, mounted on a wood or ivory handle *b*; *c* is a ball or sphere, mounted on one end of a stem or lever, which passes through and is fastened to a larger sphere *d*; the latter being attached to the under side of the holder tube by a loose joint. The further extremity of the lever is flattened, and formed into an inclined plane, which rises partly through a slot *e* in the upper part of the tube, but cannot pass quite through, in consequence of a step at its extremity. A ring *f*, which slides externally upon the tube *a*, being drawn back over the slot *e*, presses down the end of the lever, and causes the sphere *c* to impinge with considerable

Fig. 1.

Fig. 2.

force against the interior of the tube, or against a pen inserted between them. On sliding back the ring *f*, the tail of the lever rises through the slot, and the pen is released.

It will be thus seen, that the holding is effected in a very perfect and efficacious manner; the pen is steadied and supported throughout by the tube of the holder, with which it is kept in close contact by the internal pressure of the sphere *c*. The *pressure*, which is considerable, is applied *exactly in the right place*, producing a stability of holding not hitherto attained. With this holder, whatever may be the shape or substance of the pen, it will be firmly and steadily held, while at the same time it can be instantaneously released.

Mr. Longmore's unique and useful penholder is made in all the usual variety of style and ornaments, and it is no small recommendation to say, that its cost does not exceed that of the ordinary defective penholders.

P. P.

HODGSON'S PARABOLIC PROPELLER.

Sir,—I have noticed the observations of your correspondent "Inquisitivus," and am sorry that I have not sufficient data, at the present moment, to put him in possession of the information he seeks. To make the comparison he refers to, however, I can inform him that the first trial made with the propeller produced a mean speed of 9 67 miles per hour, the revolutions being 260 per minute; at a mean circumference and angle of propulsion it ought to have done 10·25 miles per hour, consequently, the slip was ·58 of a mile, or 5·65 per cent.

Since the trial made and noticed in your Magazine, No. 1104, another trial has been made with a propeller of shorter axis by an inch, and the result was at the rate of 10·4 miles per hour. I was not present at the trial, but I was informed that the power of the engine was absorbed at a less velocity than on the first occasion, and the result shows there was no slip. The surfaces of the blades are 205 square inches, or 83 inches less than the propeller referred to by your correspondent.

I quite agree with your correspondent, that the measured mile in Long Reach is the best adapted for correct conclusions on such trials, and the next trial, in all probability, will be made there, the result of which I will make known, and I feel confident that, from the developement of the powers of my propeller, in the few trials already made with it, if the trial were made with H. M. S. *Rattler*, I could propel her considerably faster than she has been by any propeller hitherto fitted to her.

I remain, Sir, your obedient servant,
R. HODGSON.

October 17, 1844.

ROYAL EXCHANGE LIGHTNING CONDUCTOR—INSULATION CONDUCIVE TO SAFETY.

Sir,—I am not quite sure that your readers would have had any great cause for rejoicing, even if they had "escaped the infliction of a disputation upon lightning conductors;" or that your pages would have been more profitably employed than in discussing controverted opinions on a practical question, about which any uncertainty prevailed, or respecting which great diversity of opinion obtains; both of which seems to be the case with lightning conductors, their best form and arrangement being by no means so conclusively established as Mr. Walker would lead us to suppose.

I am much obliged to Mr. Walker for the interesting collation of authorities he has given at page 229, and only regret that they have no bearing upon the question at issue between Mr. Walker and myself. These quotations, as well as the whole tenor of Mr. Walker's last letter, merely go to prove the propriety of establishing a free and perfect connexion between the lightning conductor and all the metallic masses within or about the building it is intended to protect. The propriety of this arrangement, be it observed, I have not yet questioned. I merely advocated the *insulation* of the lightning rod from the building itself, as will be seen in reference to my first communication on this subject. Although the electric fluid may not often be present in such quantity, or of such high intensity as to induce a lateral discharge to *bad* conducting matters as wood and stone *when dry*; yet in exposed situations, (in the tower of the Royal Exchange for instance,) both wood and stone when covered with moisture may induce the electric fluid to strike out a path for itself (accompanied with more or less danger) not in preference to, but supplemental to the course provided for its harmless transit. Although *dry* air is a non-conductor of electricity, yet when charged with moisture it becomes highly conductive. Mr. Walker's remark upon the insulating power of air, especially during thunder storms, is, therefore, somewhat unfortunate.

In conclusion, I beg to thank Mr. Wal-

ker for the trouble he has taken to enlighten me on this subject; but unless he can make out a much stronger case than he has yet done, I must be permitted to retain the opinion I have long held, that *insulation from the building*—if not absolutely essential —is highly conducive to the perfect and efficient action of lightning rods, and tends to the safety of the building to which they are attached. To quote the words of Farraday, "I have no fear of lateral discharges from a WELL-ARRANGED conductor."

I remain, Sir,
Yours respectfully,
WM. BADDELEY.

29, Alfred-street, Islington,
October 11, 1844.

MR. JOPLING'S SEPTENARY SYSTEM.

Sir,—I am very much gratified with "J. M.'s" communication on one part of my invention; and I can assure that gentleman if he could take a comprehensive view of the whole of the system, both his satisfaction and his amusement would be greatly increased.

General terms to distinguish the varieties of curves in the septenary system, may be rendered as definite as those which distinguish the conic sections; but before that can be given the register should be formed of the whole. Before a general can arrange his troops and distinguish one part from another, he must know what they consist of. An application of a line may be pointed out, but there may be many others more appropriate, and which would be selected if they were known. If the register were completed, numerous instances might be pointed out of lines from which the ancients selected their beautiful forms; and obvious reasons would appear why one line is preferable to another.

I wish mathematicians would only condescend to examine the septenary system *without*, as well as *with*, algebraic formula. I would most respectfully submit that the equation of a circle neither simplifies the comprehension of the modes by which it may be generated, nor yet the contemplation of its form.

I am much pleased with the simple term "curvetracer" which "J. M." has introduced. It is much better than "Kampograph." The "curve tracers" not only for each of the seven divisions, but the different simple forms in which they may be advantageously applied to the same division, should be distinguished.

I am, Sir, yours &c.,
JOSEPH JOPLING.

29, Wimpole-street, October 16, 1844.

THE MAGNETIC TELEGRAPH IN AMERICA.

[From the *Baltimore American*.]

Professor Morse having successfully accomplished the great essential objects of his telegraph, has lately been turning his attention to the simplification of some of the minor details with a no less successful issue. We have it in our power to mention some improvements which he has made, all resulting in economy. Mr. Morse had originally calculated that it might require a battery of at least 100 cups, to operate each circuit for 40 miles, and he actually used 80 cups in the trials before Congress last May. But he has now reduced the battery to ten cups, and by an ingenious arrangement of Mr. Vail, his superintendent, the two independent instruments are operated by this same battery of ten cups, and at the same time, too, without any interference. The telegraph has been actually efficiently operated with only two cups, from Baltimore to Washington, forty miles.—Thus is the expense of a large battery, with its dirt and care, dispensed with, and the advantage of the telegraph brought within the means of neighbourhoods, of families, and even of individuals.

Another improvement is in the number of characters which may be written in a given time. A person in Philadelphia advertised some little time ago, as an improvement, that by employing five wires instead of but one, as Professor Morse does, he could write ten letters to Professor Morse's one. We are told by one who has examined that plan, that it is a great mistake, for if Professor Morse should choose thus to complicate his registering instrument, and also to increase fourfold the expense of his conductors by four more wires, he could write double the quantity proposed by the Philadelphian plan. This improvement, therefore, reminds us of one of the Irish serjeant's commanding his men to advance five steps backwards.

The question is often asked, how are rivers to be crossed with telegraphic wires? The difficulties to be obviated are, the danger of having the conductors disturbed by anchors and drift, if they are laid at the bottom of rivers; or, if spars are erected at the proper distances apart, to carry the conductors above the tops of vessels' masts, these obstructions (not very serious, it is true) are made to the navigation. Professor Morse has obviated all these inconveniences by a peculiar arrangement, which, strange as it may seem, requires no wires through, above, or beneath the water.* In Decem-

* The English reader need scarcely be informed that Mr. Morse has, in this, as in other matters

ber, 1842, Professor Morse made an experiment across the canal at Washington, to ascertain if electricity would cross the water by this arrangement, and the result was so satisfactory that he determined to pursue his experiments at a more fitting season of the year. A few weeks ago his assistants, Mr. Vail and Mr. Rogers, proceeded to the Susquehanna river, at Havre de Grace, and repeated the experiment across that river, a mile wide, with success, and within a few days Professor Morse has made some further experiments on this method of sending electricity across water, which, we presume, he will give in detail in some scientific journal.

The results of his experiments, however, is that no wires need pass through, above, or beneath the waters in crossing rivers with the telegraph. The water itself is made by Professor Morse's arrangement the efficient conductor of electric fluid. This discovery of the Professor's is not merely of scientific but also of practical importance, and leads to new speculations on the availability of the electric telegraph in situations hitherto thought to be shut out from its advantages. We can do no more at present than to give a suggestion which we learn was made by the Professor himself, that should there be constructed a line of telegraphic conductors along the Connecticut shore of the Long Island Sound, and also Long Island Railroad, every town on the Long Island shore, and also on the Connecticut shore, would be in certain and constant communication with each other, without the necessity of any other connexion but the water of the Sound.

relating to magneto-telegraphs, only *re*-discovered what was previously well-known in this country.—See *Mech. Mag.*, Vol. xxxix., pp. 63—64, 108, 142.

THE BRITISH ASSOCIATION—YORK MEETING, 1844.

[Selected from the Reports of their Proceedings in the *Athenæum* and other journals.]

Defect of Elasticity in Rigid Bodies.

Mr. E. Hodgkinson gave an account of some further experiments which originated in the suggestion that, possibly some of the results which he had communicated at Cork, (see *Mech. Mag.*, vol. xxxix. p. 201), had originated in the friction caused by the supporters of the extremities of the bars on which the experiments were performed. He had therefore, in these latter experiments, placed strong friction wheels as supports for the ends of the bars; he had also changed the mode of measuring the deflection. He had previously used a wedge graduated on the side; he substituted for this a fine screw with a divided micrometer head, by which he could measure the 10,000dth part of an inch of a deflection. He then gave the numerical details of the sets taken by various bars after they have been loaded and then relieved. The most striking general results were, that the index of the power of the load to which he found the set taken most nearly proportional was 2; that *every load, however trivial, caused a set*, and that this set did not entirely disappear when the bar was given time to recover its state, but in general diminished greatly.

Dr. Scoresby inquired if Mr. Hodgkinson had tried whether a vibratory motion excited among the particles of the bar would enable them to recover their original arrangement.—Mr. Hodgkinson had not, but promised to attend to the hint.—Dr. Robinson suggested that the vibratory motions should not be excited with violence sufficient to cause mechanical derangement of the particles.—Lord Rosse stated two facts bearing on Mr. Hodgkinson's investigations; one, that the standards which had been made to replace those destroyed by the burning of the House of Commons had been found to alter very slightly but decidedly their dimensions, after having been finished with the greatest care. The other, than cannon were never permitted to be discharged more than 400 times under ordinary circumstances, for after that they were deemed unsafe.—Dr. Robinson stated that a fact which had always appeared very strange to him received a probable explanation from what he had just heard. It was found that the platina standard of a metre which had been constructed under the superintendence of the Academy, and which was a square prism, each of whose four faces, therefore, was entitled to be considered as the standard metre of France, when examined many years afterwards, had no two of its sides of exactly the same length: this was supposed to have arisen from the carelessness of the artist employed in its construction, who had accordingly been much censured. He now deemed it highly probable that it had been originally constructed perfect, but had altered its own form.

New Process of Magnetic Manipulation and its Action on Cast Iron and Steel Bars.

Dr. Scoresby has found that it is impossible, by the ordinary process, to communicate the full charge of magnetic influence to very hard shear-steel or cast steel bars, or such as was best suited for retaining it, and therefore best for the manufacture of compasses. But he was led by the theoretic views he holds, to try the effect of interposing thin bars of soft iron between the charging poles of the magnet, and the steel bar to be magnetized; this answered effectually,

and Dr. Scoresby exhibited several experiments, whereby, with the old process, the magnetism imparted to the steel bars was very trivial, but by the adoption of the new process, a remarkably strong charge was communicated by one single stroke of the balls of the magnet over the bar.

Importance of preserving Mining Records.

In 1838, Mr. Sopwith submitted a paper entitled "Suggestions on the Practicability and Importance of Preserving National Mining Records"—the result of which was, the appointment of a committee to draw up a memorial, and to communicate with Government, and subsequently, the adoption of the method then recommended, and the establishment of the office of Mining Records, attached to the Museum of Economic Geology, Charing-cross. A paper on the subject by Professor Ansted, of Cambridge, was read at the present meeting, of which the following is an abstract.

The object of it was to direct attention to the extent to which the mining interests of England would be promoted by the establishment of a general system of mining records, to show that Parliamentary interference is imperatively called for, if any satisfactory result is to be attained, and also that the efforts of the British Association are likely to be successful, if the proper means are taken, whether by suggestions to Government as to the most advantageous method of proceeding in, or by pressing on public attention the real importance of the subject, and inducing the Government to set on foot the necessary inquiries.

The benefits to be expected from the possession of a system of mining records will be best understood if considered, first, with reference to the miner directly, who is thus enabled to learn how he may avoid danger—and then in the application of geological facts and speculations to mining, which is chiefly difficult and doubtful because the observations on record are, in comparison with what they might be, so few, so imperfect, and so unsatisfactory.

The phenomena relative to the appearance, direction, and condition, of mineral veins, have, indeed, been almost totally neglected till within a few years, in England; and, while this has been the case in our own country, in Germany, on the other hand, such matters have been recorded in a systematic form, even from the close of the sixteenth century.

With respect to mining operations now in progress, there are many ways in which records, such as it is proposed to enforce, would be extremely useful. The drainage of one mine is not unfrequently received into other works in the vicinity at a somewhat lower level—and this is the case, not only accidentally, but often (there is reason to suppose) wilfully, an unscrupulous and dishonest owner or mine agent waiting till his more active neighbour has sunk to the deeper portions of a seam or vein, and then commencing his part of the work, allowing the water to drain into his neighbour's property. Besides this, there is another reason why such records should be enforced as a protection against dishonest mine owners, as it is not unusual in some parts of the country, where little capital is required in undertaking to work a mine, that men of no resources rent a property on speculation, paying a rent per acre of coal extracted, and then extend their underground excavations beyond the limits over which they possess a right. The coal thus dishonestly obtained is sometimes a very considerable quantity; and as the persons acting in this way do not allow their mine to be visited, or their working plans, if there are any, to be examined, there are no means by which the neighbouring proprietors can be certain whether they have been robbed or not, without applying to the Court of Chancery to enable them to investigate the case, or else sinking a shaft, and working their own portion of the seam at an inconvenient time, or in an unprofitable manner. In either case, the expense incurred is very considerable, and the thief, when discovered, is rarely in a condition to restore the value of the property stolen. Besides this wilful interference with the property of others, the absence of well-made plans, and the ignorance of the persons employed, has, in some cases, been the cause of extensive trespass being committed, and very heavy expenses incurred in litigation, before any arrangement could be effected.

With respect to mining operations that may be hereafter undertaken, we are able to form some idea of the advantage of records, by considering the extent to which they are needed in works carried on now in every mining district. The being able to avoid excavations made by former miners, and upon mines worked out and neglected, is one of the most important of these advantages. Accidents arising from ignorance in this respect are serious and frequent, and are accompanied by such extensive loss of property, and even of human life, that every one acquainted with mining operations will at once recognise the great necessity there is of some measure by which such accidents may be prevented for the future. No less than thirteen mines on the river Tyne, in the immediate neighbourhood of Newcastle,

have been either worked out or relinquished within the last fifty years, and of these no records are kept, notwithstanding that some years ago a serious accident took place, owing to the irruption of water into the Heaton Colliery, the water having accumulated in some old workings which had been relinquished seventy years. It is also a matter of no little economical importance, that in some cases, owing to the want of records, a coal-pit has been sunk, and other expensive operations carried on, upon a wrought-out seam of coals. But, besides the advantage of being able to avoid the danger and mischief arising from a too near approach to these old workings, the rapid improvements that are constantly taking place in machinery, and the discoveries by means of which mineral produce, at one time useless, may at another be of some value, render it extremely desirable that the circumstances under which old works are abandoned should be in all cases clearly recorded.

In Saxony, "when a mine is to be abandoned, an officer called the 'Superintendant of Mines,' and others whose duty it is to inspect the mines from time to time throughout a district, and report on their condition, visit the works, detach portions of ore if any is to be obtained, assay the ore, note its condition and value, and mark down these observations on a ticket, which they attach to the specimen, and which it is their duty to preserve carefully. They register, in a book kept for the purpose, all the circumstances which have led to the abandonment of the mine, mentioning the magnitude of the vein, the hardness of the rock, the proportion of ore it contains, the depth of the workings, the nature, direction, and magnitude of the galleries, and the distance to which each has been carried." An accurate map of the underground works in each level is also preserved, and such an account of the appearances of the surface that the mine and each shaft can at any time be identified.

Mr. Sopwith observed, that exact information would not only be conducive to the progress of geological science, but of the highest importance to the general interests of the country. Notwithstanding all that had been done, much remained to be done, and he was convinced that the sanction and aid of the legislature could alone effect a general registration of mines.—Mr. J. Taylor described several instances of the evils resulting from the want of such information. On one occasion 80,000*l*. had been expended on a copper mine in Cornwall, which became less productive the deeper it was worked, and was finally abandoned. In this case a minute record was kept of the state of the operations, and the reasons for their abandonment, so as to afford a complete refutation of the pretensions of a company which had been recently formed for the purpose of reopening the works. In Mexico, on the contrary, workings had become unprofitable on account of their expense, during the war with Spain, a record having previously been made of the state of every part of the mine. These mines had subsequently been drained and reopened under Mr. Taylor's directions, and the account of them found to be very correct. He was convinced that much loss of life and much expensive litigation might be avoided, if mine-owners were bound by law to keep a record of their proceedings. There ought to be no mystery or secret in mining; it answered no good purpose; in the mining operations of Cornwall for fifty years there had been no secrets; a meeting was held every two months, at which all accounts were made up and made known publicly.—Sir H. T. De la Beche attributed many of the accidents in the mines to the absence of documents respecting old workings and adjacent mines. The Government had done all in their power for the preservation of mining records, but difficulties had been experienced in inducing interested parties to avail themselves of the opportunities thus afforded.

THAMES STEAMERS—THE "METEOR."

Sir,—Your correspondent "Curve," No. 1105, appears to forget the subject of his letter in No. 1090, wherein he mentioned the *extreme slightness* of the *Meteor*. I challenged him to the proof of his assertion, which he has never given. He states in No. 1094, "*Not having had an opportunity of ascertaining by measurement the exact dimensions, I may possibly have been deceived in my judgment.*" I considered this concession a reply to my challenge, as it proved his utter ignorance of the matter, and his error in writing from hearsay.

I am, &c.,

W. Cormack.

October 10, 1844.

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No. 1107.] SATURDAY, OCTOBER 26, 1844. [Price 3*d.*

Edited by J. C. Robertson, No. 166, Fleet-street.

HARDY'S PATENT IMPROVEMENTS IN TUBE-ROLLING.

Fig. 1.

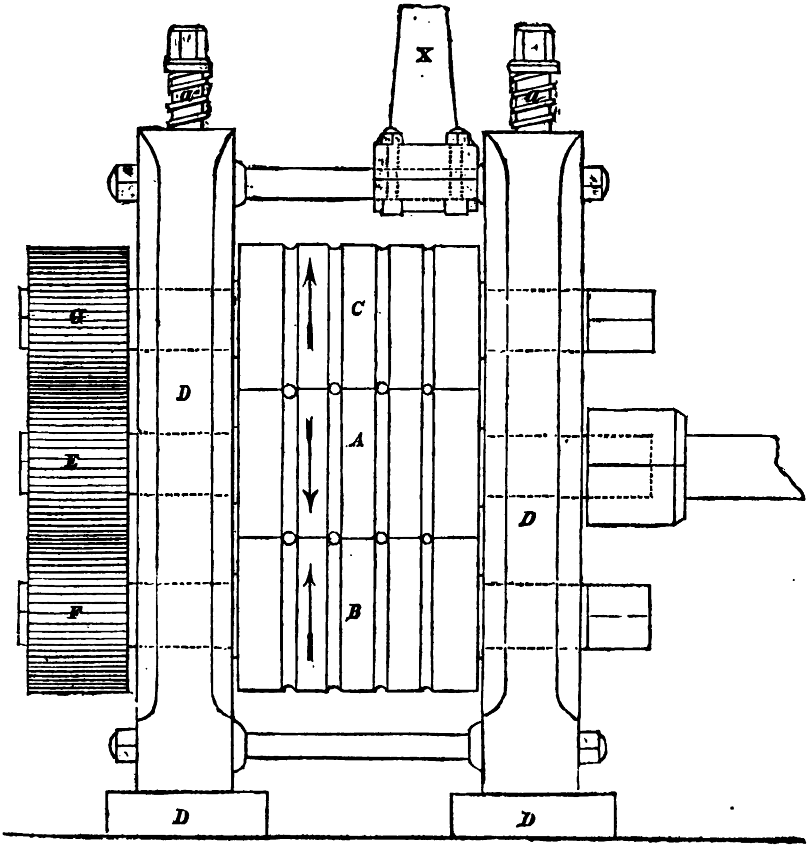
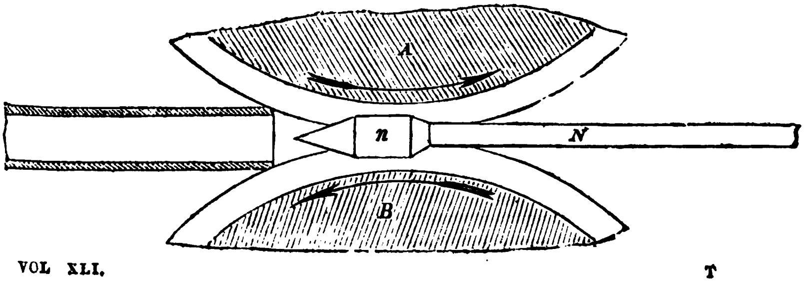


Fig. 2



HARDY'S PATENT IMPROVEMENTS IN TUBE-ROLLING.

[Patentee, James Hardy, of Birmingham, gentleman. Patent dated, March 28, 1844; Specification enrolled, September 26, 1844.]

The improvements which form the subject of this patent are stated in the specification to "relate to the process of welding tubes, pipes, or hollow rods of malleable iron, by machinery of the kind or description commonly called revolving grooved rollers, which process was invented by Henry Osborne, who obtained a patent for the same on or about the 1st of March, 1817,* and who brought the said process into use for the welding of short and thick iron tubes for making gun barrels at his manufactory, called the Bordsley Works, Birmingham, and which process has since become common in Birmingham." We are further informed that, "in the said process, as hitherto practised, two revolving grooved rollers are used, one such roller being placed above another like roller, so that the two rollers constitute a pair, which are turned round by wheelwork with equal and corresponding motions, and the skelp, or piece of prepared iron, which is to be welded into a short and thick tube, is passed through between such pair of revolving grooved rollers, in such manner as to effect the welding of the edges of the iron skelp together, a mandril being used for keeping open the interior hollow through the tube."

Now the improvements made by Mr. Hardy in this process consist in employing "at least three revolving grooved rollers," "such rollers being disposed one above another, so as to constitute in effect and operation at least two pairs of revolving grooved rollers, *the middle roller of the three being common to both pairs.*"

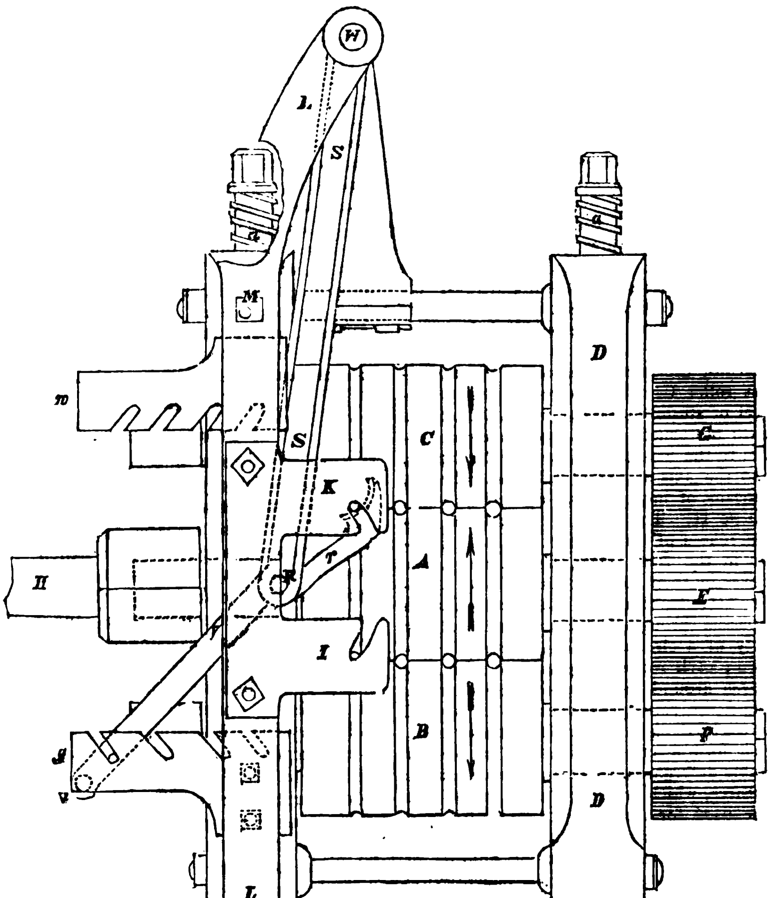
No other novelty than this is described, and none other is claimed; and what that novelty amounts to is made so perfectly plain and intelligible by the brief description we have just quoted, that it may be safely pronounced to be impossible, by any multiplication of words, or terms, or phrases, to make it a whit plainer or more intelligible. As with some people, however, there is such a thing as "gilding refined gold," so there are others who fancy they can polish sunbeams; and the framer of the present specification would seem to be of the number. For, incredible as it may appear, he has actually contrived to fill no less than the prodigious number of *one hundred and seventy-six folios* (exclusive of a large sheet of illustrative drawings) with explanation upon explanation, of the manner in which this clear-as-day affair, of making three rollers serve the office of four is accomplished. Never, surely, was there such a specimen (except, it may be, from the same pen) of accumulative verbiage seen. Some few words more than those we have quoted might possibly have been necessary for form's sake; but certainly all that was needful to satisfy the demands either of law or of common sense, might have been said in as many words as there are folios. Were this a solitary instance of undue lengthiness in specifying, and were the patentee himself the only sufferer by it, we should have passed it over as a matter of private concernment merely; but there are other interests affected by it which compel us to speak out, and denounce it in plain terms, as typical of what has become an intolerable nuisance. It will be allowed to be no more than fair, that when persons who are engaged in any branch of trade or manufacture have their freedom of action interfered with by the grant of a patent, they should be enabled to ascertain for themselves, at as little trouble and expense as possible, the extent of the patentee's rights. But an office copy of this prodigy of a specification costs no less than 12*l.* 18*s.*!!—a price so enormous as to amount in effect to an absolute denial of information, or, in other words, of justice. And this, not because of any extravagance in the fees of office, but solely because of an extravagance of verbosity in the framer of the specification, which, though it has its imitators, has not, we believe, its like, either in ancient or modern tautology. The public at large, too, may well complain; for after having conceded the monopoly of a valuable invention for a long term of years, they have a good right to expect that they shall be able, when the day of reversion comes, to lay their hand on it at once; it could be no part of the implied bargain between

* For the history of Osborne's patent, and others to which it has given rise, see *Mechanics' Magazine,* Vol. xxxvi. p. 365.

the parties, that they were to be left to search for the gem amidst a mountain of rubbish. The legislature did wisely when in passing the late Act for the Registration of Articles of Utility, they provided that both drawings and description should be contained on one side of a single sheet of paper; and they would not act less wisely were they to extend a little of the same protecting care to the case of specifications of patents.

The reader will not expect, after what we have said, that we shall inflict upon him much of the tediousness of the particular specification before us; but as we have not heretofore given in our

Fig. 2.



pages any description of the tube rolling process, of which Mr. Hardy's is an improvement, we shall avail ourselves of this source to supply a few particulars.

Fig. 1 of the accompanying figures is a front elevation, and fig. 2, a back elevation of a set of three revolving grooved rollers arranged according to the present patent.

"A is the middlemost of the three revolving rollers, B the lowermost, and C the uppermost of those rollers, D D, the cast-iron standards of the framing containing brass bearings, in which the several necks or

pivots of the rollers are sustained; *a a* are setting screws at the upper parts of the framing D D, for holding down the said brass bearings, and the screws *a a* are set or adjusted, so as that the three rollers will be kept with the surfaces of their circumferences in easy contact one with the other, but will be firmly retained from separating one from the other when the rollers are revolving, and the heated iron is passing through between them. E F G are three toothed pinions fastened on the ends of the pivots, or axes of the three rollers A B C. The three pinions are all alike as to size and number of teeth, and their teeth act together in order to cause all the three rollers to turn round with equal velocities, and each roller in the proper direction, so that the circumferences of the three rollers will accompany each other at the places where they are respectively in contact one with the other,—viz., the highest part of the surface of the circumference of the lowermost roller B, is in contact with the lowest part of the surface of the circumference of the middlemost roller A, and the highest part of the surface of the circumference of the middlemost roller A, is in contact with the lowest part of the surface of the circumference of the uppermost roller C. The power of the water-wheel or steam-engine by which the rollers are to be turned round, may be communicated to the axis of the lowermost roller B, or to the axis of the middlemost roller A, by means of any suitable connecting axis, such as H. The grooves around the circumferences of the three rollers A B C appear in the front view, fig. 1, and those grooves by their correspondence leave apertures between them for the heated iron to be passed through, which apertures are very nearly of a circular form as already mentioned; each roller is represented with four grooves around its circumferences (see fig. 1), and the correspondences of the several grooves leave eight nearly circular apertures, which form a series diminishing in size by suitable differences. The two largest of the apertures, which are nearly alike in size, are to be used for welding with a mandril, and the other apertures are to be used for elongation without a mandril, but the number of grooves in the rollers, and consequently the number of apertures may be varied at pleasure. I and K are the fixed stops which are set up at a suitable distance behind the rollers, for the purpose of catching the projecting circular disks at the end of the stem of the mandril, so as to retain the mandril motionless, whilst the heated iron is carried over the bulb end of the mandril, when the heated iron is in the act of passing through between the revolving rollers as hereinbefore explained. The stops I and K are flat plates of iron fixed at suitable distances behind the rollers, the said plates being supported on a standard L L, which stands up from the floor, and is held firm by a long horizontal bolt, M, extending, as is seen in figure 2, from one of the standards D D of the framing, to the upper end of the standard L. The distance between the stop plates I K, and the vertical centre lines of the axis of the rollers, must suit the length of the mandril, and that must exceed the length of the longest tube pipe or hollow rod, that is required to be welded by action of the rollers, and the length of the stem of the mandril (see separate view on an enlarged scale, fig. 2) is sufficient to reach from the said stop plates I or K to the rollers, so that when the bulb *n* at the end of the mandril is lodged in either of the apertures between the rollers, the other end of the stem of the mandril will at the same time be lodged in the notch of one or other of the stop plates I or K, which notches correspond to the two largest apertures left between the corresponding grooves around the rollers shown in figure 1, so that there is one notch for each of those apertures, and exactly in the horizontal centre line, or continuation thereof."

COST OF PATENTS.

Sir,—Within a short period I have been applied to by several persons, some of them quite strangers, who have, what they allege to be valuable inventions, for the economic application of which they require patronage and capital. One or two of them I took the liberty of sending to you, for I believe it is in your way to afford counsel and assistance to such persons. In most instances the chief obstacle to the benefit which they proposed to confer at once on society and themselves by their inventions, was the enormous expense of taking out the requisite patents to afford them a chance of being remunerated for the labour of producing their several contrivances. Now, as this expense is, to my knowledge, the only obstacle to several inventions being published, some of which, I do not hesitate to say, promise to be of extensive utility, I have been naturally led to consider whether the whole of this expense be absolutely necessary.

It is needless to enlarge on the economic advantages to society of contrivances for facilitating the production of wealth; they must have been, at least partially, appreciated from the earliest period. In-

deed their employment is the essential condition of civilization. We may therefore very safely assume, that the limited monopoly of the use of their inventions granted to patentees is not so much intended for the individual benefit of the patentees themselves, as for encouraging the production of such contrivances for the general benefit of society; which being admitted, it follows that if, by unnecessary expenses, inventors are prevented from obtaining that very protection for their property in their inventions which is intended to stimulate the production of such useful contrivances, our practice is completely suicidal to our, in this instance, enlightened policy.

That all the present expenses of patents cannot be justly termed *necessary* expenses may be inferred from the fact, that designs are registered, and the designer effectually protected from piracy, under the new law for about a thirtieth part of the expense of a patent; and surely the official fees need not be greater in one instance than the other.

It is, perhaps, hardly needful for me to say anything on the subject of the granting of patents being made a source of revenue. I should think no one out of Bedlam would have the hardihood, after the reduction of the stamp duty on newspapers and the adoption of a penny postage, to defend a source of revenue, which is a direct obstacle to the use of contrivances for the production of that very wealth out of which taxes must be paid, if paid at all. It may perhaps be objected, that a vast number of patents for things useless or frivolous, would be solicited if the pecuniary obstacles at present existing were reduced. I fear there is some truth in this; but alas, wisdom and wealth are not inseparable, and no one knows better than yourself, Mr. Editor, that this evil is not *entirely* prevented by the 400*l.* property qualification of patentees under the present system. Indeed, I much doubt, if the *proportion* of absurdities would be greater under a cheap system, than it is now under the present dear one; perhaps from the circumstance that practical men, *i. e.*, the better class of workmen, being then enabled to become patentees, we might be led to infer, that if their specifications contained less of the nomenclature of science than some to which we might refer, they would indicate the possession of at least as much useful knowledge.

I had written thus far,—I hope your readers will not think it *too* far,—when it occurred that it might be objected, that the great number of claims, were patents cheap, might cause litigation. Should this effect follow it must be admitted to be an evil, but it is one which would most probably cure itself after a time. It is a strange way, however, of preventing litigation, to render it so artificially expensive as to be beyond the means of those who most need the protection of the law; this appears, to say the least, very like a denial of justice, (or at least of law, for they are not always identical,) and after all, for what purpose? Simply that civilization may not progress *too* fast; or in other terms, that mankind may not be *too* well fed, *too* well clothed, *too* well housed, in a word—*too* happy; a result, no doubt, very much to be feared if society had the benefit of all the contrivances to enhance its comfort—if inventors were not unnecessarily prevented from securing to themselves *a chance* of being justly rewarded for their labour, which certainly they have not at present. Indeed the state of moral feeling on this subject is so low, that rival manufacturers seem hardly aware, that when they pirate each other's designs, which are unprotected by patent, they commit a theft as dishonourable and cowardly as stealing any other property with certain impunity; for alas, "Ye know not what manner of spirit ye are of."

I remain, Mr. Editor,

Yours respectfully,

ALFRED SAVAGE.

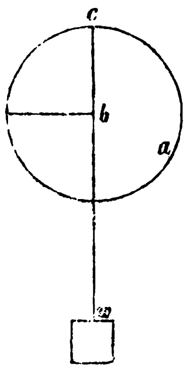
Steeled Mill-maker and Machinist, 43, Eastcheap.

THE CRANK, AND LIPSCOMBE'S PATENT SUBSTITUTE—"S. M." IN REPLY TO "N."

Sir,—Without being at all ruffled by "N's" very civil observations in disparagement of my mechanical attainments, I shall proceed to make such reply to what he has said on the real matter in hand, as will enable your readers to decide with tolerable certainty, which of us is best entitled to indulge in such imputations.

I do not think that there could have been a more conclusive argument brought forward by "N" in favour of the crank than the one he has made use of with an opposite intention. Upon referring to the figure in his last communication, it will be seen that when the point *c* in the periphery of the wheel has arrived at the lowest point of its orbit, the weight will then have fallen

through a space equal to the diameter of the wheel. Now, in doing so, it will have communicated a certain amount of the velocity it would itself have acquired to the fly wheel; while, on the other hand, it will retain some part of that velocity, that which it has communicated to, and is concentrated in the wheel, will go to counteract the onward (or, in this case, downward) tendency of the weight. If the momentum of the wheel should exceed the momentum of the weight at that moment when the point c in the periphery of the wheel has arrived at its lowest position, then the weight will be lifted up; if the momentum of the wheel be less than that of the weight, then the weight will only at that instant receive a check to its downward course equal to the momentum of the wheel, and will not, therefore, ascend upon the opposite side at all. Let us now, by the application of these principles, proceed to investigate more in detail the effects produced by a weight upon a fly-wheel. Let



a represent the wheel, of which b is the centre, and c a pin upon the periphery, to which the weight w is attached. We shall suppose that the wheel is of such weight, that, with a moderate velocity, its momentum is sufficient to raise up the weight w (that is, in other terms, that the fly-wheel is of sufficient weight for the power and resistance which are applied in connexion with it). If the pin c, to which the weight w is attached by means of a string, be brought to the top centre, and there let go, to what height will the pin c ascend on the other side? This *is the point* to be determined. In all the standard works which treat of central forces, it is demonstrated and proved, "that when a body revolves in a circle by means of central forces, its actual velocity is the same as that which it would acquire in falling through one half the radius of the circle described under the constant action of the centripetal force." The centripetal force in this case is the weight w; and the velocity, v, which it would acquire in falling through $\frac{r}{2}$, one half the radius, would be $= \sqrt{64 \times \frac{r}{2}}$ (by the theory of falling bodies), which is the velocity acquired by the wheel, and which must also be the velocity which the weight w has itself acquired; having expended the remaining part of the velocity on the wheel, which it would otherwise have acquired, or had concentrated within itself, had it been allowed to have fallen freely through space. But as it is an established and fundamental law in mechanics, that "action and reaction are equal and opposite," it follows that, as the wheel a has received a certain impulse by the weight w acting upon it for a certain time in descending through one part of its orbit, it ought to ascend on the opposite side thereof to exactly the same height. So far as friction is concerned, it may for the present be passed over, although, under even the most favourable circumstances, that would be something; but as it has been before proved that the weight w has acquired a velocity

$$= \sqrt{64 \times \frac{r}{2}},$$ that must first be deducted,

as it has to be overcome, as well as the weight itself to be lifted. We shall now proceed to find out the distance which a body must fall to acquire that velocity, which will be the amount to be subtracted from the distance to which the momentum of the wheel would lift w, if w had had no acquired velocity at the instant the point c began to ascend on the opposite side. Well, we find that the space $s = \frac{64 \times \frac{r}{2}}{32} = r$ (by the theory of falling bodies); from which it appears that, as r, or the radius, is to be subtracted from $2\ r$, or the diameter, the effect produced ought to be that the weight w shall ascend only one half the height from which it fell; that is, that the point c shall ascend to the height of r, which is on a level with b the centre. From which we deduce and prove that no power is lost by the arrangement in question, in so far as respects the theory, and from which we are also led to infer that in practice no farther power would be lost than that, at each stroke of the engine, &c., we should lose a power equal to the weight of the connecting-rod and piston, raised through the length of the crank, together with what is due for friction, which "N's" own experiments in connexion with the above process of reasoning prove to be comparatively small.

In reference to the first experiments and arguments deduced therefrom by "N," and

of which he says, "that I do not attempt to grapple with the peculiar points on which he rests his case,"—namely, those that prove the loss of power by the crank, it will be necessary to have recourse to No. 1101 of the *Mechanics' Magazine*; where it will be seen that no engineer ever thinks of applying the power of an engine to the crank in the position in which it is represented in fig. 1—that is, upon the dead centre; but even if it were so, and the whole pressure of the steam were allowed to fall upon the piston at that point, there would be no actual loss of power, because there would be no waste of steam. The moment that there is a movement made by the piston, there is an expenditure of steam; but there is also an equivalent motion communicated to the crank, and it will be fully shown hereafter that that amount of power which is exerted by the steam on the piston is as faithfully and fully transmitted, without any loss, by the crank, as by any substitute for it.

With respect to figs. 2 and 3, in "N's" communication before referred to, in No. 1101, of the *Mechanics' Magazine*, these do not fairly represent the relationship which subsists between the power of an engine and the resistance to be overcome thereby. "N" has therein supposed an impossibility, and what no practical engineer expects his engine to perform. We shall, for the purpose of investigating "N's" "particular points upon which he rests his case," suppose that the diameter of his wheel is 10 feet, making the circumference 31·416 feet. He has a weight of 100 lbs. appended to the crank, which is the same length as the diameter of the fly-wheel, and also 100 lbs. weight attached to the periphery of the fly-wheel by means of a cord, so that it may be wound up thereon. Let us, however, investigate how matters would stand if the crank were put to the top centre, and then made to travel over the semidiameter of the circle it describes. The weight which is appended to the crank pin would then have descended through a perpendicular height of 10 feet, or twice the length of the crank, but the equal weight attached to the periphery of the wheel, must have travelled over a perpendicular space of $\frac{31 \cdot 416}{2} = 15 \cdot 703$ feet, or one-half the circumference of the fly-wheel. Surely no practical engineer supposes that he can make such an engine or machine, which, with a prime moving power of 10 lbs. applied to it, shall overcome a resistance of 15·703 lbs! To do this would be to realize the *fata morgana* of mechanics, the vision of perpetual-motionists.

My remarks have already extended so far that I must conclude without entering, as I had intended, into an investigation of the power transmitted to the crank by the quantity of steam expended in the cylinder of a steam-engine, by which I should have clearly shown that no power is lost by its application. I am, Sir, yours truly,

S. M.

THE BRITISH ASSOCIATION—YORK MEETING, 1844.

[Selected from the Reports of their Proceedings in the *Athenæum* and other journals.]

The Smoke Nuisance—Fairbairn's New Boiler.

Mr. FAIRBAIRN made a communication relative to the progress of the Committee appointed to inquire into the combustion of fuel and the prevention of smoke. The subject had been discussed at a former meeting of the Association, but from the difficulties which surrounded the inquiry, and the various opinions which are entertained, as to the management and conditions of the furnace, and the changes which take place, the Committee have been unable satisfactorily to themselves to bring their labours to a close. Mr. Fairbairn, however, laid before the Meeting the results of a number of experiments on the different kinds of fuel; and provided it be correct, that the heating powers of any description of fuel is a proportional of the quantity of carbon it contains, it then follows, that every kind of coal which yields the greatest quantity of carbon will be found the most advantageous in the uses and economy of the furnace. In assuming this to be the case, Mr. Fairbairn gave an analysis of a variety of fuels; of which we may enumerate the following:—

		Carbon.
Caking coal	contains	75·48
Splint coal	,,	75·00
Chevay coal	,,	74·45
Cannel coal	,,	64·72
Welsh furnace coal	,,	88·06
Welsh stone coal	,,	89·70
Welsh slaty coal	,,	84·17
Derbyshire furnace coal	,,	52·88
Derbyshire cannel coal	,,	48·36

From the above it will be seen that a great deficiency exists in the quantity of carbon in the Derbyshire coal, as compared with the Welsh and others above enumerated. The Newcastle, Durham, and Lancashire coals were also examined, and from a careful analysis by Mr. Richardson, the two former were found to contain—

Carbon	85·613
Hydrogen	5·205
Azote and Oxygen	7·226
Ashes	1·956
	100

The Lancashire gave nearly the same

results, with the exception of a slight deficiency in carbon, and rather more ashes—

Carbon	82·90
Hydrogen . . .	5·86
Azote and Oxygen . .	7·91
Ashes	3·26
	100

In addition to the above, a number of other kinds of fuel, such as lignite, turf, and some prepared fuels were analyzed; and from their constituents were found more or less adapted to the purposes of the furnace; and, taking a general average of the whole, it appeared that the bituminous coal, which contained the greatest proportion of carbon, was the best calculated for the objects intended in the inquiry. The different kinds of anthracite were probably an exception, as regards the quantity of carbon they contain; but, taking into consideration the extreme tenacity of this description of fuel, it was considered more obdurate as a free burning coal than those previously examined. Mr. Fairbairn next went on to discuss the proportions of the furnace to the heating surface of the boiler. On this subject a great diversity of opinion prevails; and from the variety of forms, conditions, and proportions of furnaces, the greatest perplexities were created, and the difficulties increased in coming to a decision on these points. It however appeared, from a series of experiments and observations, that the furnaces in ordinary boilers were too large for the number of square feet exposed to the action of the fire, and that the best proportions for stationary boilers were, as 1 of grate bar to 30 of recipient surface, and as 1 to 15 in marine boilers. On the evaporative powers of boilers, and the intensity of heat in the flues, a considerable number of experiments had been made, and a number of diagrams from Mr. Henry Houldsworth's pyrometer, indicating the temperature of the flues and the condition of the furnace, under every change and circumstance, were laid before the Meeting. The diagrams exhibited the changes which were constantly going on in the furnace and the flues, as the gases were evolved from the commencement of every change of coal to its final combustion. These laborious experiments (made under the direction of Mr. Houldsworth, and extending over a period of nearly two years) were too voluminous to be read to the Meeting, and were therefore reserved for future reference in the Report.* Mr. Fairbairn concluded with the description of a newly-invented boiler, which seemed to possess many excellent qualities for the economy of fuel and the prevention of smoke. The boiler was of a very simple construction, of the cylindrical form, and contained two internal flues, about 2 feet 6 inches diameter, extending the whole length of the boiler. Each flue contained a separate furnace, which, surrounded in every direction by water, formed a ready absorbent for the radiant heat, as it passed off from the fire. On this plan the gases from both fires were carried forward through the whole length of the flues to the opposite end, where they unite, and where a new and additional process of combustion takes place. From the description thus given, it would appear that the operations of the double flues were useful in effecting the ignition of the gases as they came in contact respectively from each surface. The original intention of the double flues and fires was not to lessen the smoke, but to enlarge the steam space, and prevent what is technically called priming in the boiler. It, however, exhibited peculiar properties, and by a simple process of firing the furnaces *alternately*, the whole phenomena of nearly perfect combustion is accomplished. To effect these objects, it is only necessary to charge the furnaces alternately every half hour, and it will be found, that during the time one fire is replenished with fuel the other is making gas, and the currents from the clear burning fire passing off at a higher temperature than the carbonaceous matter evolved in the newly-charged furnace, the products are ignited the moment they come in contact, and the nuisance of smoke by these simple means prevented.

* For a description of Mr. Houldsworth's pyrometer and the results obtained by it, see *Mech. Mag.* vol. xxxvii. pp. 57, 131; and vol. xxxix. p. 463.

Steam Navigation in America.

Dr. Scoresby observed, that the extent of navigable waters in North America, including the coast lines and the waters of the British possessions, might be roughly estimated at 25,000 to 30,000 miles. He then alluded to the introduction of the steam-boat by Mr. Fulton, in 1807, and the rapid progress that had been made, and directed attention to the peculiarities of some of the boats, the construction of the cabins on deck, and the application of the hull of the vessel entirely to cargo, the working of the rudder at the forepart of the vessel by means of communicating rods, the use of a distinct boiler and machinery to each paddle, &c. With regard to speed, he observed that it was much beyond that of our steam-boats, from the circumstance of the Americans adopting the high-pressure principle. Whilst our boats were worked at a pressure of 5 lbs. to the square inch, they thought nothing of 100 lbs. or 150 lbs. pressure. The most extraordinary performance of American steamers was effected by the *J. M. White*, in the summer of this year. She made her way against an

average current of from 3 to 4 miles an hour, from New Orleans to St. Louis, a distance of 1,200 miles, in three days and 23 hours, remaining a day and a half at St. Louis, unloading and loading, and reached New Orleans again, having performed a distance of from 2,300 to 2,400 miles in little more than nine days. The average speed, taking advantages and disadvantages into consideration, would be 16 miles, or perhaps near 14 knots per hour.

Resistance of Railway Trains.

Mr. Scott Russell detailed a number of experiments on the Sheffield and Manchester Railway. For the purpose of these experiments it was necessary that the railway should present long and very steep gradients. The experiments were as follows:—1. Trains of carriages, empty, were put in motion at the summit of an inclined plane, at about 30 miles an hour, and were allowed to descend freely. 2. Trains of carriages, loaded, were tried in the same way. 3. The engine and tender were treated in the same way, being put to a velocity of between 30 and 40 miles per hour, and allowed to descend freely the whole length of the inclined plane without any train attached. 4. The engine and tender, with a train attached, were propelled to the top of the inclined plane, and then allowed to descend freely by gravity. By these means the following results were obtained:—1. The resistance to railway carriages at slow velocities does not exceed 8 lbs. per ton. 2. The resistance to a light railway train of six carriages, at 23·6 miles an hour, was 19 lbs. per ton. 3. The resistance to a loaded train of six carriages, at 30 miles an hour, was 19 lbs. per ton. 4. The resistance to a light train of six carriages, at 28 miles an hour, was 22 lbs. per ton. 5. The resistance to a loaded train of six carriages at 36 miles an hour, was 22 lbs. per ton. 6. The resistance to a six-wheeled engine and tender, at 23·6 miles an hour, was 19 lbs. per ton. 7. The resistance to a six-wheeled engine and tender, at 28·3 miles an hour, was 22 lbs. per ton. 8. The resistance to a train composed of six light carriages, with engine and tender, at 32 miles an hour, was 22 lbs. per ton. 9. The resistance to a train composed of nine loaded carriages, with engine and tender, at 36 miles an hour, was 22 lbs. Mr. Russell observed, that the subject was of considerable importance, inasmuch as the system adopted for laying down the gradients of new lines was of necessity regulated chiefly by the opinion of the engineer on the question of resistance. How much mechanical force is required to move a given weight of train, along a given gradient, at a given speed, was a question of which the solution was essential to sound engineering, but the profession had long felt that they were not in possession of sufficient data to determine this question.

Workshop Micrometer.

Mr. Whitworth described an instrument for measuring bodies with a very minute degree of accuracy. It consisted of a strong frame of cast iron, at the opposite extremities of which were two highly-finished steel cylinders, which traversed longitudinally by the action of screws one-twentieth of an inch in the thread; these screws were worked by two wheels, placed at opposite extremities of the frame, the larger of which had its circumference divided into five hundred equal parts; the ends of the cylinders, at the places where they approached each other, were reduced to about a quarter of an inch, and their hemispherical ends were highly polished. To measure with this instrument, the large circle was brought to its zero, and the body to be measured being placed between the cylinders, the small circle was turned until the two cylinders touched the opposite sides of the body, which being removed, and the large circle turned until the ends of the two cylinders were brought to touch, the turns and parts of a turn required for this gave the breadth of the body which had been interposed to the ten-thousandth part of an inch, and since the one-tenth of one of the divisions could be readily estimated, the size of the body could be thus estimated easily to the one-hundred thousandth part of an inch. Mr. Whitworth stated, that in the accuracy required in modern workshops, in fitting the parts of tools and machines, the two-foot rule heretofore in use is not by any means accurate enough; his object was to furnish ordinary mechanics with an instrument which, while it afforded very accurate indications, was yet not very liable to be deranged by the rough handling of the workshop; and he conceived this instrument secured those advantages. It surprised himself to find how very minute a portion of space could be by it, as it were, felt. By it the difference of the diameters of two hairs could be rendered quite palpable.

Hydrogen Furnace.

The Rev. W. V. Harcourt read a report of some experiments which he had made on vitrification. Dr. Faraday, in his experiments on glass, had the greatest difficulty in procuring perfectly homogeneous masses, arising in most cases from the almost impossibility of procuring a regulated heat in the ordinary furnaces. Mr. Harcourt, impressed with the advantages which might be gained for optical purposes, by procuring glasses formed by other salts and bases, instituted the experiments referred to. It was

considered, that if a tribasic phosphate formed a glass, and the bibasic phosphate formed a glass, we should have, in all probability, glasses having different optical properties. Finding difficulty in proceeding with these experiments, at the heat given by ordinary furnaces, and the risk to which the platina crucibles were exposed, he was induced to try the effects of hydrogen burning in common air. Dr. Dalton was consulted on the construction of the first hydrogen furnaces, and he suggested the difficulty which was found to arise in practice—that hydrogen gas burning, through small orifices, with great pressure, would blow itself out. This difficulty was, however, overcome in the management of the apparatus here described. This apparatus consisted of an iron tube, in which the gas was generated, by the addition of 15 ounces of sink to three-quarters of a pint of oil of vitriol and ten pints and a half of water. The gas produced was found to be in ten minutes under a pressure of 21 atmospheres, in sixteen minutes and a half under a pressure of 25 atmospheres, and in eighteen minutes under a pressure of 26 atmospheres. The gas was conducted into another cylinder, and from thence to the jets, over which was suspended a platina crucible. The gas being ignited at these jets, maintained, with the above charge, the platina crucible at a white heat for twenty minutes. Gems had been fused by the heat thus generated. Several kinds of jets were used, as it might be necessary to surround the crucible with heat, or only to apply the heat to the bottom of it. Experiments with this apparatus have been made upon the phosphates of antimony, zink, barytes, and cadmium. The results have not been, however, quite satisfactory. In some the striæ interfered with the transparency of the glass formed; and in the case of the monobasic phosphate of zink, it was found that, to whatever heat the compound may have been exposed, the glass thus formed was deliquescent.

Dr. Faraday bore testimony to the advantages of this arrangement. He had found in all his experiments on glass, in which the elements were chemically combined, that crystallization took place. He regarded all common glass as examples of solution, rather than of chemical combination. Borate of lead and silicate of lead, if fused in small quantities, so that they cooled quickly, were transparent, but if fused in masses, which required a longer time, they were in a crystalline condition.—Mr. Harcourt remarked, that in the monobasic phosphate of zink, which was transparent when vitrified, the quantity of acid was probably exceedingly small, but this glass was striated.—Dr. Faraday said, that some of the purest specimens of American ice show similar striæ, although it was in a state of exceeding purity, yielding the purest of all water when liquefied.—(*To be continued.*)

TO WHOM THE COUNTRY IS INDEBTED FOR STEAM NAVIGATION.

"*Invention of Steam Navigation.*—It appears *from a printed circular*, which has just been sent us, that the merit of this discovery is due to a man named Taylor, a native of Cumnock, who first succeeded in propelling a boat by steam, in the year 1788. In acknowledgment of this claim, a pension of 50*l* per annum was settled upon his widow by Government, and a donation of 50*l*. was subsequently made to each of his four surviving sisters; but as this is justly deemed a poor remuneration for such important services, it is suggested that a national testimonial should be made to the widow and family of Mr. Taylor."—*Times*, Oct. 19.

We have read the preceding announcement with no small surprise, or rather, to say the truth, with extreme disgust. The pretensions of Taylor have been long since so completely scouted by the engineering world, that it augurs no ordinary degree of hardihood and folly in his family to attempt to revive them. They would do wisely to rest content with, and grateful for, the singularly good luck which they have already experienced. A "national testimonial," forsooth! Yes, when nations are in the habit of rearing monuments to undoubted pretenders and impostors, and cities and towns of contending for the honour of having given them birth—then doubtless will a testimonial of the first order be due to Taylor, and Cumnock become as sacred to pilgrims' feet as Stratford-on-Avon, or the Banks of Doon. The simple and incontestable truth is this, that all that Taylor did in the matter was to lend the real and true inventor, William Symington, the slight help of an introduction to an influential patron—that he afterwards did his best to rob Symington not only of the honour, but of the profit of the invention—and that, by his artful representations, he so far prevailed with Government as to induce them to commit the *grand national mistake* of conferring on the Taylor family rewards due only to that of Symington. Such of our present readers as may desire to know more particularly, on how slender a foundation the claims of Taylor rest—how powerfully supported the rights of Symington are by all contemporary testimony, while the only vouchee Taylor could ever produce was *Taylor himself*—will do well to refer to the 19th and

35th volumes of our journal, where they will find the whole matter thoroughly and (we do not hesitate to add) impartially investigated.

Now that the subject has been thus revived, of the indebtedness of the nation for the vast services rendered to it by steam navigation, we would fain indulge a hope that it may have the effect of inducing the nation at last to show their gratitude where gratitude is due. We look upon it as a great blot on the character of the country that the FAMILY OF SYMINGTON should remain to this day without the slightest mark of public honour or esteem. The Government, by the rewards which they granted to the widow and children of Taylor, distinctly recognised the fact of there being a debt owing to the inventor of steam navigation; and since a debt paid to a wrong party is not paid at all, all that is now demanded on behalf of the Symington family is the liquidation of this acknowledged debt. The only question which can be considered open for consideration is the amount of that debt; and on this head we will only observe, that what might thirty years ago, when steam navigation was but in its infancy, be considered a liberal enough grant, can furnish no criterion for the decision of the Government of the present day, when the advantages derived by the country from this source, have been multiplied more than a hundred-fold.

PROGRESS OF SCREW-PROPELLING.

A number of experiments have been recently made under the superintendence of the Engineer Department of H.M. dockyard, Woolwich, to test the comparative merits of several of the rival screw-propellers. The vessel employed on the occasion was the *Rattler*, which, it will be remembered, was built for the express purpose of such trials. The propellers tried have been those of Mr. Smith (commonly, but improperly, called the Archimedean), Mr. Woodcroft, Mr. Sunderland, and Mr. Blaxland (or Steinman); for the distinguishing features of each of which the reader may refer to our 39th vol., pp. 292, 341, 359, 388. The trials have been all made over the measured distance in Long Reach; and it is only due to the Government officers to say, with uniform impartiality and fairness. We give in a tabulated form the results of these trials:—

Table of Screw Experiments with H.M.S. "Rattler."

1843.		Average Speed in knots per hour.	Average Speed of engine per minute.	Remarks.
October.	Mr. Smith's Screw	7·750	22·5	Vessel uncoppered.
	Do. . .	8·264		Vessel coppered. Screw in both these instances 5 ft. 6 in. long.
	Mr. Woodcroft's .	8·632	27·97	Propeller with two blades: when unshipped it was found to have been warped, and altered in form in the course of the experiment.
1844.	Do. . .	8·159	24·15	Propeller with four blades.
Oct. 4.	Mr. Smith's .	9·659	25·25	Vessel masted; propeller reduced to 15 inches in length, and 10 ft. diameter, and of slight make, adapted to rivers merely; new wheel gearing, consisting of one wheel of 3 ft. 6 in., and another 14 ft. 6 in.
10.	Mr. Sunderland's.	8·380	17·49	
12.	Mr. Steinman's (Blaxman's)	9·538	25·06	Propellers of sea-going strength.
15.	Mr. Sunderland's.	8·346	18·1	
17.	Mr. Smith's .	9·893	27·01	New screw, similar to the former, but much stronger.

THE "WATER LILY" SCREW STEAMER.

Since the experiments mentioned in the preceding page, a new and very promising competitor for screwpropelling fame has made its appearance in the River; (in addition to the parabolic propeller of Mr. Hodgson, noticed in our last two Numbers); we allude to "the *Water Lily*," an iron schooner, of about 170 tons, just built by Messrs. Ditchburn and Mare, and engine fitted by Messrs. Maudslay, Sons, and Field. The engines are of the direct action, low pressure class, with 14 inches stroke; and the screw is of the common sort, 8 feet diameter, and 16 feet pitch. The vessel has a double rudder on the plan patented by Mr. Joseph Maudslay, and described in *Mech. Mag.*, vol. xl., p. 129; which has enabled the constructors to fix the screw abaft of the stern-post outside of all, whereby the tremulous motion observed when the rudder is immediately in the rear of the screw, is avoided, and perhaps also something gained in point of diminution of resistance. On Friday, the 19th inst., a trial took place with this vessel on the same measured ground, where the experiments with the *Rattler* were recently made, when, according to the statement of a correspondent, on whose accuracy we place every reliance, she realized a speed of NEARLY THIRTEEN MILES AN HOUR, *which exceeds by more than a mile the greatest speed attained in the course of the Government experiments.*

THAMES STEAMERS.

Sir,—In a scientific journal of the extensive circulation, and the high standing of the *Mechanics' Magazine*, I feel so fully assured of your desire to have nothing but simple facts stated, that I trouble you with this communication without apology to say, that the assumption made in the account of the trial of the *Wonder* atmospheric steamer, in No. 1104, October 5, of your Magazine, of that vessel having performed at the rate of 17½ miles per hour through the water, is greatly in error. I make this assertion from a conviction (derived from much careful inquiry and observation) that *no vessel on the Thames*—excepting, perhaps, the *Eclipse*, or *Isle of Thanet*, but including the *Wonder*—has ever yet, by simple steam power, exceeded the extraordinary speed of 16 miles per hour *through the water.*

Recurring again to the speed of the *Wonder*, I beg to draw your attention to the extreme uncertainty, and fruitful source of error, arising from assuming by mere conjecture the rate of the tide, as was done in the statement in your journal of the mode adopted of determining the speed of that vessel; indeed the adoption of such a vague and inaccurate method leads one to doubt whether the stated speed of 14½ miles per hour against the tide was correctly taken, and, if determined by one run, the conclusion that every person conversant with the subject must arrive at, is altogether against any dependence being placed on its accuracy.

A trial made, as nearly as possible at high water, by means of the measured mile at Long Reach, and the runs up and down repeated a sufficient number of times, and with great care in keeping a straight course, and in sufficient depth of water, is easily accomplished, and is, at the same time, the most accurate way of arriving at the truth.

A dissemination of a knowledge of the simple truth is everywhere desirable, and is most strikingly so in things of a scientific character generally, and especially in this, which is in a state of such rapid progressive improvement.

I am probably better acquainted than yourself with the impressions produced by the statements contained in your pages in other countries; and where people look for, and depend upon getting correct information, they should be exposed to the least possible chance of disappointment.

In conclusion, I ought to observe that, after so much having been said respecting the superior speed of the *Wonder*, as compared with other fast vessels, it is believed by those connected with the *Prince of Wales*, that had she had equal advantages of being clean, and the same attention paid to obtaining the utmost effect from her machinery, she would have been at least equal in speed to the *Wonder*.

I remain, Sir, your obedient servant,

MERCATOR.

London, October 17, 1844.

THAMES STEAMERS.—THE METEOR.

Sir,—I had by no means forgotten what had been written either by Mr. Cormack or myself concerning the *Meteor;* and I think his own memory might be complained of with greater justice; for he puts a meaning upon a single sentence of mine, which a perusal of the whole letter would show it was never intended to bear. I stated that the *Meteor* was as slight as possible; Mr.

C. replied that she was as strong as, or stronger, than any of her competitors. Certainly these are very contradictory opinions. From the warmth of Mr. Cormack's language, he evidently thinks mine injurious to the boat; but I fancy her builders would consider his own the worst compliment, as a slight boat, although it will not wear so well, will, under similar circumstances, attain a higher speed than one that is stouter. Mr. C. asked me to prove my statement; and said he had ample proof of his own, which he would bring forward if it were still contradicted. I then gave the grounds of my opinion, and asked for the proofs he had promised of his own; but, instead of giving them, he makes the excuse that I must be perfectly ignorant of the subject, because, not possessing exact measurements of the *Meteor's* scantling, I allowed the possibility, although not the probability, of my judgment being incorrect. If Mr. C. does not, you, Mr. Editor, and your readers do know that none but those who are intimately connected with either the builders or the proprietors of a boat are allowed to measure her; but that, nevertheless, all have the opportunity of using their eyes, and a person accustomed to such matters can judge of strength nearly as well by inspection as by actual measurement; his assumption is therefore entirely unwarranted. I was so far from yielding the point as he supposes, that I asked for the proofs which were so satisfactory to himself, in the full expectation of being able to show their insufficiency. If he wishes to overthrow an opinion which is so prevalent, he must bring those proofs forward, and submit them to criticism; indeed, I do not see how, having once promised, he can on any grounds consistently refuse to do so.

I am, Sir,
Your obedient servant,
CURVE.

P.S. It is most probable that Mr. Cormack has compared the *Meteor* with boats that are shorter, and whose lines are not so fine, and which would, consequently, be subject to much less strain.

LIGHTNING CONDUCTORS.

Sir,—Professor Murray's lightning-conductor—namely, a copper tube with perforations below its apex, to allow the two surfaces to act "as a conducting medium," described in Vol. xli., p. 184 of your Magazine—appears to me to be by far the best conductor for buildings yet proposed; but I recommend that it be "attached to the wall" of the building by slate-holders, instead of iron. Welsh slate is an excellent substance for the above purpose, being a bad conductor, and tough, and easily sawn or cut to any shape needed; and a hole can without difficulty be perforated of the proper diameter for the passage of the rod.

Faithfully yours,
ARTHUR TREVELYAN.

Newcastle-upon-Tyne,
October 17, 1844.

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN OCTOBER.

WEALE'S QUARTERLY PAPERS on ENGINEERING. Part V. Contains: Treatise on Heat, translated from Peclet.—Page's Report on the Harbours of Holyhead and Port-Dyn-llaen.—Captain Boswell's Model Plan for a Harbour in connexion with Granton Pier.—The Iron Roof of the New Houses of Parliament.—On Slate Quarries, by Mr. Hughes.—Sargent's Lecture on American Steam Navigation.—Arago's Report on Atmospheric Railways.—Cast Iron Bridge over the Nevka at St. Petersburgh. 7s. 6d.

WEALE'S QUARTERLY PAPERS on ARCHITECTURE. Part V. 7s. 6d.

RECENT IMPROVEMENTS in ARTS, MANUFACTURES and MINES. Being a Supplement to his "Dictionary." By Andrew Ure, M.D., F.R.S., &c.,

PRACTICAL TUNNELLING; explaining in Detail the Setting Out of the Works, Shaft Sinking, and Heading, Driving, Ranging the Lines, and Levelling under Ground, Sub-Excavating, Timbering, and the Construction of the Brickwork of Tunnels, with the amount of Labour required for, and the Cost of the various portions of, the Work, as exemplified by the particulars of the Blechingly and Saltwood Tunnels. By Frederick Walter Simms, F.R.A.S., F.G.S., M. Inst. C.E, Civil Engineer. 21s.

EXPERIMENTAL RESEARCHES in ELECTRICITY. By Michael Faraday, D.C.L., F.R.S., &c. Vol. ii. 9s.

LECTURES on PAINTING and DESIGN, delivered at the Royal Institution, &c. With Designs drawn on Wood by B. R. Haydon, Historical Painter: and engraved by Edward Evans. 12s.

AN INTRODUCTION to ZOOLOGY. By Philip Henry Gosse, Author of "The Canadian Naturalist." 12s.

MANUAL of ELEMENTARY CHEMISTRY, THEORETICAL and PRACTICAL. By George Fownes, Ph.D. 12s. 6d.

PRACTICAL ASTRONOMY and GEODESY. By John Narrien, F.R.S. and R.A.S. Professor of Mathematics, &c. in the Royal Military College, Sandhurst. Being the Third Volume of the Sandhurst College Text-Books. 8vo.

THE MONSTER TELESCOPES erected by Earl of Rosse, Parsonstown; with an Account of the Manufacture of the Specula, and full Descriptions of all the Machinery connected with these Instruments. Illustrated by Engravings. 2s. 6d.

ALGEBRAICAL PROBLEMS, producing Simple and Quadratic Equations, with their Solutions; designed as an Introduction to the higher branches of Analytics. 8th edition. To which is added, an Appendix, containing a collection of Problems on the Nature and Solution of Equations of higher dimensions. By Miles Bland, D.D, F.R.S, &c. 10s. 6d.

Periodicals.

The Horticultural Magazine. No. I.
The Electrical Magazine. By Mr. C. V. Walker. (Quarterly). No. 6.

[Other scientific journals as in last monthly list.]

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC., CAP. 65. FROM SEPTEMBER 25, TO OCTOBER 23, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Sept. 27	279	Thomas Moulson	Sheffield	Improved carpenters' brace head.
28	280	Clarke and Timmins	28, Exeter-row, Birmingham	A loose convex washer for castors.
,,	281	John Fenton	Ockbrook, near Derby	Design for gloves and mitts.
,,	282	Henry Spicer	Regent-street, Westminster	Aquatic life-preserver.
Oct. 1	283	Edward Thomas, Lord Thurlow	Ashfield Lodge, Ixworth, Suffolk	Quadruple brechin and expanding rose for fire-engines
,,	284	Ditto	Ditto	Improved bit.
2	285	William N. Nicholson	Newark	Compound wedge for varying the distance between rollers in grinding, crushing, pressing, &other similar machines
3	286	John Hutchings	Bath	Bootmakers' blocking machine
4	287	John Tarring	23, Charles-street, Middlesex Hospital	A ventilator specially adapted to smoky chimneys.
5	288	George Miller Clarke	55, Albany-street, Regent's-park	Complete mortar or night light.
,,	289	W. Young	Queen-street, Cheapside	Design for the vase of an Argand lamp of glass or earthenware.
9	290	Benjamin W. Hickling	Noble-street	Improved shirt collar.
11	291	James Boyd	78, Welbeck-street, Cavendish-square	Economical kettle.
16	292	William Blenkiron	Wood-street, Cheapside	Improved shirt collar.
19	293	Edwin Edward Cassell	Milwall	Design for raising and lowering the wicks of lamps.
22	294	John & Edward Butler	Walsall	Cigar case.
,,	295	James Jones	Bow-street, Covent-garden	Pendant gas lamp.
,,	296	Richard Edmunds	Banbury	Seed depositor.
23	297	William Hodgson	149, West-street, Sheffield	The tailors' instrument for ascertaining the exact shape of the bodies and waists of all sizes of persons proportioned and disproportioned without rule or calculation, and forming the same on the cloth.

LIST OF ENGLISH PATENTS GRANTED BETWEEN SEPTEMBER 26, AND OCTOBER 24, 1844.

Edward Coke Wilmot, of Haddenham, Bucks, for improved apparatus for warming beds, persons, carriages, and rooms. September 26; six months.

Thomas Clark, of Wolverhampton, ironfounder, for an improved domestic convenience. September 26; six months.

Sir George Steuart Mackenzie, of Coul, county of Ross, baronet, for an improvement or improvements in the manufacture of paper, more particularly for the purposes of writing and copying writings, and machinery for effecting the same, also the manufacture of a fluid or fluids to be used with the improved paper in the manner of ink. September 26; six months.

John Berkeley Cotter, of Dublin, gentleman, for improvements in the preparation and manufacture of woven fabrics, or tissues applicable to various useful purposes. September 26; six months.

Alexander Turnbull, of Russell-square, doctor of medicine, for a new mode or method of more expeditiously and effectually tanning hides and skins, and of extracting and separating the catechuic acid from the tannic acid in the catechue or terra japonica used in tanning. September 26; six months.

Alexander Ramuz, of Frith-street, Soho, cabinet-maker, for improvements in sofas, wardrobes, ottomans, bedsteads, and other apparatus for reclining or sleeping on, and in the construction of dining and billiard tables. (Being a communication.) September 27; six months.

James Carter, of Delabole, Cornwall, gentleman, for improvements in cutting slate for roofing, and other purposes. September 27; six months.

Henry Ritchie, of Lincoln's-inn, gentleman, for improvements in carding engines. (Being a communication.) September 27; six months.

John Harcourt Quincey, of Old-street, gentleman, for improvements in the manufacture of blinds and shutters. September 27; six months.

Samuel Cunliffe Lister, of Manningham, worsted spinner, for improvements in preparing and combing wool. September 27; six months.

William Thomas, of Cheapside, merchant, for improvements in looms. (Being a communication.) October 3; six months.

Samuel Pritchett, of Charlbury, Oxford, glove-maker, for certain improvements in cutting and making up gloves. October 3; six months.

Albert Daniel Hindley, of Berner's-street, Oxford-street, carpet manufacturer, for improvements in the manufacture of carpets, and other piled fabrics. October 3; six months.

William Newton, of Chancery-lane, civil engineer, for improvements in machinery for letter-press printing. (Being a communication.) October 3; six months.

Obed Mitchell Coleman, of Fitzroy-square, gentleman, for improvements in piano-fortes. October 10; six months.

William Henry Ritchie, of Lincoln's-inn, gentleman, for improvements in obtaining copper from ores. (Being a communication.) October 10; six months.

John Bower Brown, of Sheffield, merchant, for improvements in combining cast-steel with iron, and in the construction of carriage springs. October 10; six months.

Joseph Eugene Chabert, of Chancery-lane, gentleman, for improvements in preparing materials to be used in making picture and other frames, and for architectural, and other purposes. October 10; six months.

Henry Oliver Robinson, of Old Jewry, engineer, for certain improvements in steam machinery, and

apparatus for the manufacture and refining of sugar. October 10; six months.

George Hurwood, of Ipswich, engineer, for improvements in apparatus for moving and fastening windows. October 14; six months.

John Smith, of Salford, weaver, for certain improvements in the manufacture of fabrics suitable for ornament or dress. (Being a communication.) October 14; six months.

Adolphe Nicole, of Dean-street, Soho, watchmaker, for improvements in watches and chronometers. October 14; six months.

Sir Graham Eden Hamond, baronet, of Norton Lodge, Yarmouth, for improvements in the mode of fastening on and reefing paddle-wheel float-boards, or paddles. (Being a communication.) October 14; six months.

William Clarke, of Nottingham, lace-manufacturer, for certain improvements in machinery for manufacturing ornamental bobbin net or twist, lace, and other fabrics. October 14; six months.

Peter Borrie, of Princes'-square, St. George's in the East, civil engineer, for certain improvements in the machinery for the manufacture of sugar. October 17; six months.

Arthur Parsey, of Spur-street, Leicester-square, artist, for improvements in obtaining motive power. October 17; six months.

Edouard Guignes, of Peckham, gentleman, for improvements in printing on leather and skins. (Being a communication.) October 17; six months.

Paul Chappe, of Manchester, spinner, for "certain improvements in machinery or apparatus for spinning and doubling cotton, and other fibrous substances. October 17; six months.

Alexander Wright, of Hales'-place, South Lambeth, engineer, for certain improved apparatus for measuring gas, water, and other fluids, and in the means of manufacturing the same. October 17; six months.

Frederick Herbert Maberly, of Stowmarket, clerk, Stephen Geary, of Hamilton-place, New-road, architect, and Joseph Croucher, of James-street, Buckingham Gate, gentleman, for certain improvements in the construction and arrangement of machinery or apparatus for clearing, cleansing, watering, breaking up, and raking of streets, roads, lands, and other ways. October 17; six months.

John Grieve, of Portobello, Scotland, engineer, for certain improvements in the production and use of steam applicable to steam-engines. October 17; six months.

James Nasmyth, of Patricroft, Lancaster, engineer, and Charles May, of Ipswich, engineer, for improvements in working atmospheric railways, and in machinery for constructing the apparatus employed therein. October 22; six months.

John Henry Rehé, of Moscow-road, Middlesex, surgeon, for improvements in the manufacture of starch and farinaceous food. October 22; six months.

Frederick Ransome, of Ipswich, carter, for improvements in the manufacture of artificial stone for grinding, and other purposes. October 22; six months.

George Osmond, of London-street, Tottenham Court-road, cabinet-maker, for improvements in fastenings for doors, drawers, window-sashes, and dining tables, and in apparatus for suspending looking-glasses, and other articles. October 22; six months.

James Napier, of Hoxton, dyer, for improvements in treating mineral waters, to obtain products therefrom, and for separating metals from other matters. October 22; six months.

Moses Poole, of the Patent Office, London, gentleman, for improvements in machinery for emptying privies and cesspools. (Being a communication.) October 22; six months.

Henry Carbines, of Hayle, Cornwall, brazier, for certain improvements in fuses, cartridges, and other like explosive instruments. October 24; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM 22ND SEPTEMBER TO 22ND OCTOBER, 1844.

Peter Rothwell Jackson, of Strawberry hill, near Manchester, Lancaster, engineer, for certain improvements in the construction and manufacture of wheels, cylinders, hoops, and rollers, and in the machinery or apparatus connected therewith, and also improvements in steam valves. Sealed September 24.

Wilton George Turner, of Gateshead, Durham, doctor in philosophy, for an improved mode of directing the passage of and otherwise dealing with the noxious vapours, and other matters arising from chemical works in certain cases. September 25.

Thomas Fuller, of the firm of William Collier and Co., of Manchester, Lancaster, engineer, for certain improvements in machinery, tools, or apparatus for turning, boring, and cutting metals, and other substances. September 30.

Henry Oliver Robinson, of No. 12, Old Jewry, London, engineer, for certain improvements in steam machinery, and apparatus for the manufacture and refining of sugar. October 1.

Pryce Buckley Williams, of Llegodig, Montgomery, North Wales, for certain improvements in the manufacture of artificial stone. October 9.

Jean Baptiste Paul Chappe, of Manchester, Lancaster, spinner and doubler, for certain improvements in machinery or apparatus for spinning and doubling cotton, and other fibrous substances. October 9.

Jacob Samuda, of the Southwark Iron Works, engineer, and Joseph D'Aguilar Samuda, of the same place, engineer, for certain improvements in the manufacture and arrangement of parts, and apparatus for the construction and working of atmospheric railways. October 10.

William Clarke, of Nottingham, lace manufacturer, for improvements in machinery for manufacturing ornamented bobbin net or twist lace. October 15.

William Cormack, of York-street, Commercial-road, Middlesex, manufacturing chemist, for a new or improved method or plan for purifying coal-gas. October 15.

Vice-Admiral Sir Graham Eden Hamond, baronet, K.C.B., of Norton Lodge, Yarmouth, Isle of Wight, for improvements in the mode of fastening on and reefing paddle-wheel float boards, or paddles. (Being a communication.) October 15.

George Augustus Kollmann, of the German Chapel, St. James's palace, Middlesex, gentleman, for certain improvements in railways and locomotive and other carriages. October 16.

William Henry Ritchie, of Lincoln's-inn, Middlesex, gentleman, for improvements in obtaining copper from ores. (Being a communication from abroad.) October 17.

Richard Roberts, of the Globe Works, Manchester, Lancaster, engineer, for certain improvements in machinery or apparatus for the preparation of cotton, wool, and flax, and also for spinning and doubling cotton, silk, wool, and other fibrous substances. October 19.

John Grieve, of Portobello, Edinburgh, Scotland, engineer, for certain improvements in the production and use of steam applicable to steam-engines. October 21.

Robert Hazard, of Clifton, near Bristol, confectioner, for improvements in baths. October 21.

Pierre Armand Lecomte de Fontainemoreau, Skinner's-place, Sise-lane, London, for a new mode of constructing barometers, and other pneumatic instruments. (Being a communication from abroad.) October 22.

John Henry Rehé, of Moscow-road, Middlesex, surgeon, for improvements in the manufacture of starch, and farinaceous food. October 22.

NOTES AND NOTICES.

American Lead Trade.—The lead trade in Wisconsin and Galena is now a business of a million dollars a year. Only ten years ago, Great Britain exported to the United States 9,792,000 lbs. The tables are now turned—for, in the past five years, the Americans have imported none of the article, and in 1841 commenced the exportation of large quantities of it to England. The English have heretofore supplied the China market, where immense quantities of it are used in lining tea-chests, &c. Three years ago, the Boston merchants made shipments of the article to Canton, and, being able to undersell the British, the trade in one year increased to an export of about 1,510,136 lbs. The exports of the past year have greatly exceeded the previous one. In 1830 the product of all the lead mines in the United States was a little rising 10,000,000 lbs., and they imported for their own consumption. In 1841, they not only supplied themselves, but a regular export of it is now made to various foreign countries.

Foundations of Sand.—No dependence can ever be placed on a building of which the foundations are not laid on thoroughly-drained ground; but a very ingenious method has been lately adopted of avoiding the evils of a slippery clay foundation, by cutting a large trench below the substructure of a building, and filling it in with sand well rammed. It is found that, when courses of stone are laid on such a basis, no settlement takes place; and it appears that this method has been successfully practised in some of the ancient buildings of Egypt.—*Ansted's Geology.*

Selection of Building Stones.—I have been told by a practical man, who had been employed in selecting stone for an important public building about to be erected, that in looking out for good stone he was accustomed to go to the churchyard in the neighbourhood of the quarries he wished to judge of, and examine on all sides the oldest tombstones that were there. He found that he could determine by that means the relative value and durability of most of the stones in the neighbourhood, because they were there exposed under almost all conceivable circumstances. A laminated stone, however, that might be extremely decomposable as a tombstone, would not necessarily be bad in the wall of a building, where its edges only are exposed. —*Ansted's Geology.*

Whitelaw and Stirrats' Water Wheel is, from its superior efficiency, fast superseding the Fourneyron turbine on the Continent. Mr. John Hamilton and Messrs. Escher, Wyss and Co., of Zurich, have lately taken down five turbines and replaced them with the Scotch wheel, which appears from numerous experiments made by these parties, to realize no less than 75 per cent. of the theoretical power of the water.

The Empire Steam-boat (United States).—This steam-boat which has just been completed, is 260 feet in length; and measures 1,220 tons—being 200 tons larger than any other *fresh* water steam-ship in the world! The engine power is 600 horse. The main cabin is probably without equal, being 211 feet (fourteen rods) long, lighted the entire length through painted glass under the roof, and so arranged that it can be divided by folding-doors into three apartments, fitted up in the most splendid style.

Cheap Church Bells.—The *Irish Ecclesiastical Journal* informs the clergy that they can substitute cast-steel bars for the ordinary church bells with very considerable advantage, as regards both tone and cheapness. Any clergyman can procure for 30*s.* a bar of cast steel, producing a better tone than the ordinary small church bells, which cost from 4*l.* to 6*l.*

Damp Walls.—When damp walls proceed from *deliquescence* in the case of muriate of soda, &c., an intimate combination with the sand used for the mortar, it is merely necessary to wash the wall with a strong solution of alum. This converts the *deliquescent* salt into an *efflorescent* one, and the cure is complete. Or, alum may be added to the plaster in the first instance.—*Dr. Murray.*

Armenian Cement.—Dissolve five or six bits of gum mastich, each the size of a large pea, in as much spirits of wine as will suffice to render it liquid, and in another vessel, dissolve as much isinglass, previously a little softened in water, (though none of the water must be used,) in French brandy or good rum, as will make a two-ounce phial of very strong glue, adding two small bits of gum galbanum or ammoniacum, which must be rubbed or ground till they are dissolved. Then mix the whole with a sufficient heat. Keep the glue in a phial closely stopped, and when it is to be used, set the phial in boiling water.

Canal Steam Navigation.—Mr. H. Davies (the inventor of the disc engine) has constructed eight towing-boats, fitted with disc engines, for the Birmingham and Liverpool Junction Canal Company, and these are now, and have been for upwards of twelve months, regularly employed in carrying on an extensive traffic on a line of canals extending from Autherley, near Wolverhampton, to Ellesmere Port, on the Mersey, a distance of sixty-nine miles, in which two trains, usually consisting of six or eight loaded boats, are started from each terminus of the above line every day, and, by this means, a quantity of merchandise, averaging between 2,000 tons and 3,000 tons per week is conveyed by the use of steam-power on canals. The average weight of merchandise conveyed in each train exceeds 100 tons, and the haulage of this for one mile is effected by the consumption of less than ½ cwt. of coal; consequently, the power of hauling one ton of goods one mile is yielded by the consumption of *less than half a pound of coal.* The engine is managed by one man; the train of boats is steered by one man; and the sole additional attendance is that of a conductor (whose chief duty is to prevent pilferage), except in passing locks, when extra assistance becomes necessary. An equal quantity of goods could not be moved by horse-power, without the continued employment of six horses, with the requisite relays for changing these, and at least twenty-four men on board the boats.

The "Great Britain."—The alteration in the entrance to Cumberland Basin for the admission of the *Great Britain* is proceeding in the most satisfactory manner; and we are happy to announce that that noble vessel will enter Cumberland Basin on or about the 20th instant, and will proceed from thence to Kingroad, on the highest tide in the early part of November.—*Bristol Mirror.*

Reaping Machine.—A letter from Warsaw of the 4th inst. states, that MM. Tymenzezki and Kacsynski, engineers of this city, had just invented a reaping machine, which was tried in the presence of the Governor, the Prince de Paskiewitz, and several engineers. The machine worked admirably, and in less than an hour had cut down an acre of oats, and piled up the straw with as much regularity as if it had been done by the hand. Such a machine, of the largest dimensions, would cost about 5,000 florins of Poland, or 300*l.*—*Times.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1108.] SATURDAY, NOVEMBER 2, 1844. [Price 3d.

Edited by J. C. Robertson, No. 166, Fleet-street.

FLETCHER'S IMPROVED MANGLE.

Fig. 1.

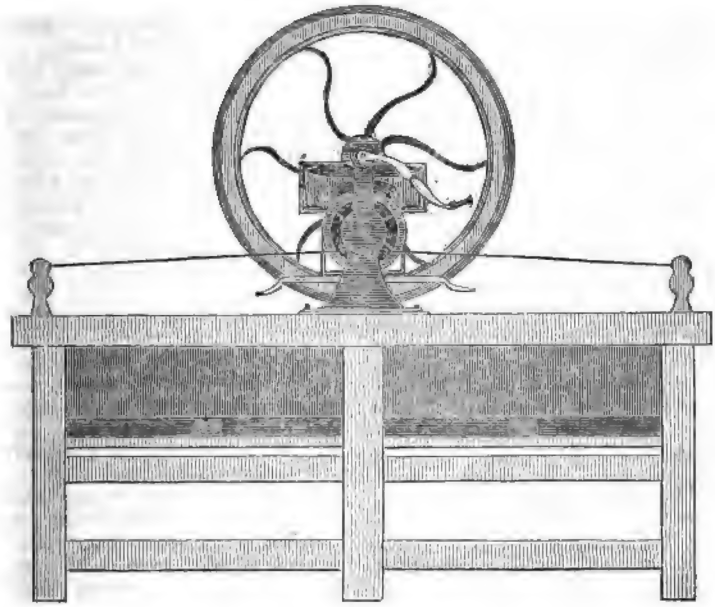
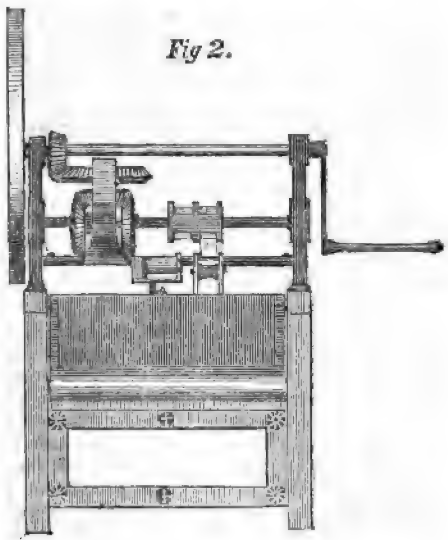


Fig 2.



Sir,—I send you a sketch of a mangle, which I think will be found in several respects superior to those in common use. Fig. 1 is a front elevation, and fig. 2 an end elevation of the machine. The diameters are taken from the pitch lines, as being most convenient.

The framework is of the common form, excepting only that the ends and middle are cast-iron frames connecting the sides. On both sides are strips to keep the rollers within the frame. There are rolled iron plates on both sides of the box, to work against the bowls, which are let into the top frame, having no more play than to allow of their working easy. In the middle of the box, and lengthways, is a plank 2 inches thick, a convenience for fastening the stands. Of these stands, two on the left side I call spring stands; the other two, bowl stands.

The top shaft is 1⅛ in. thick, finished. The fly-wheel that hangs on the end is 2 ft. 6 in. in diameter, and weighs 1 cwt. The small bevel-pinion, with its back up to the casting, is 3½ in. diameter; pitch, ⅝ in.; breadth of rim, 1¾ in. The larger wheel working into this is 12 in. diameter. The next wheel, joining with its back upward, is 6⅝ in. diameter; pitch, ¾ in.; breadth, 1¾ in. The two latter wheels are fastened by a pin (like a small upright). The top of this upright is just clear of the cross shaft. There is not much room between the face of the wheel and the under side of the cross shaft, owing to the pinion being small; but the casting that passes is thin just over the teeth, broader in the middle, and strengthened on the under side in the dished part of the wheel. The bottom of the upright rests in the lower part of the wheel frame, which is in two parts. The bottom of this frame, resting upon the broad part of the cross-bearer, is not one whole bottom, but branches inwards, and is very narrow, as there is a slot-hole in the middle of the cross-bearer. Upon this slot there rests a kind of wrought iron stud, about 1¼ in. square at the bottom, tapering a little upwards, the top branching out in a circular form, so as to go into the groove of a coupling or catch-box, that slides on the square part of the shaft between the wheels. What I have called the bottom of the square stud is the shoulders on which it has to slide; the slot being only ½in. wide, the end reaches through, and to it, is connected a piece of flat iron plate 1¾ in. broad, and ½ in. thick. The end of each lever is connected to the other end of this plate on the upper side of the plate to the round stud.

The low shaft is the same length as the other, with a pair of wheels whose diameter is 8½ in. These move in contrary directions. The slide catch-box has a lug at each end, but at opposite angles. The lugs catch the short studs that project from the inside of the wheels, and are thrown into gear by the action of the springs on the edge of the levers when the box comes up. The cross-bearer is branched out a little just where the lever works on the pins at each side. The dimensions of the levers at the broad end are 1½ in. broad, ⅜ in. thick; the distance from the centre pin connected with the plate underneath, to the side pins, is 3¼ in. each way; and from the side pin to the end of the levers, 8 in.

The hole in the lever ends is of oblong form, that the strong stud may work one lever, being cranked at that part where the other lever rests on it, the levers being even on the top sides. The stands called spring stands are bolted on the 2 in. board, and at the height of 2¾ in., the stand branches in an oblong form in the direction of the spring, which is straight, and made of slender saw-plate. The springs are 4 in. long, and 2⅜ in. broad. At one end of this oblong part of the stand is a stud of a flat form, about 3½ in. long, ¾ in. broad, and ¼ in. thick; on the other end is a round stud, of equal length, ¾ in. thick. The brass cup covers this round stud-pin, being whole at the top. It is 3¼ in. long, and of an oblong form, 2 in. broad, 1⅛ in. thick outside. The inside is ¾ in., or rather wider than the pin is thick, and ¼ in. longer. The cup (which is fastened to the spring) just presses against the pin at the side nearest the mangle end, so that when the brass cup comes on the end of the lever, the spring not being sufficient to draw the catch off, the stud of the wheel gives way, till the cup presses against the stud. It is then a solid body, and in an instant the motion is changed. The moment

the slide catch is clear of the stud in one wheel, the spring, having been held back, is at liberty, and as quick as thought is thrown into gear of the other wheel. Thus the motion is changed every time the box comes up.

There is an iron boss on the cross shaft, having two grooves, one for each strap. The straps fold on the under side, the other end being connected with the top of the bowl stands, just over the bowl. The inclines turn towards the handles, and when straightened out for the purpose of changing the clothes-roller, the bowl that runs up the incline has reached the even part at the moment of the change of motion.

I remain, dear Sir,

Yours truly,

JAMES FLETCHER.

Colnefield, Colne, Lancashire,
August 14, 1844.

THE CALCULATOR. NO. XV.

Devices of Calculation.—Savings' Bank Weekly Interest Table.

An indispensable adjunct to a Savings' Bank, is the Table for computing interest. The common tables are unsuited to this purpose, even when they are constructed at the requisite rate per cent., which is seldom the case. The proper form is that which is constructed upon a plan converse to the usual one, and of which we have an example in the Tables of Interest at 5*l.* per cent., by J. G. Pohlman.* Smaller ones expressly adapted to what must now be called the *old* Savings' Bank rates, were published by the late C. Compton.†

As 3*l.* per cent. is a rate of interest which will hereafter be applicable to the middling and larger class of banks, I intend to show the construction of a weekly table at that rate, and to take the opportunity it affords of explaining a method, which, though it may be, and probably is, privately used by some, is not, as far as I am aware, in print.

I must first observe, that besides the 52 weeks, of which a year is commonly said to consist, there is a surplus, amounting to five days in every four years, and producing five additional weeks in the course of 28 years; the 53rd week occurring uniformly (except interfered with by the centurial year) at intervals of 6 + 5 + 6 + 5 + 6 years. The managers of Savings' Banks, must either allow no interest for this intercalary week, or use an interest table which makes provision for it. I prefer the latter.*

The basis of the table is, the sum of which the interest for one week is exactly one penny: 52·17857 ÷ 7·2 = 7·2470. Therefore, to form the table, a series of multiples of the latter quantity is required, each term of the series being reduced, or rather brought up, to an integral value, since no interest is allowed on any fractional part of a pound. At least 664 multiples will be required, the last being equal to 4812·008, and its interest for a week, 2*l.* 15*s.* 4*d.* Now, in forming such a series there would be three places of decimals to each term, making an aggregate of nearly 2,000 figures, useless except for the purpose of ascertaining the integral figures. I propose to show how they, and with them a great deal of labour, may be dispensed with.† Let the first half of the series be first computed, being 332 terms, ending with 2406·004. Prepare a sheet containing 332 lines, or rather, 4 divisions of 83 lines each. Now, 7·247 = 7·25 − ·003, and to construct a column C of the multiples of 7·247 make two auxiliary ones, A and B, of the multiples of 7·25 and ·003 respectively, these being so easy that they could be written *currente calamo*. The first eight terms will stand thus:

Line.	A	B	C	A′	diff.
1	7·25	−·003	7·247	8	8
2	14·50	−·006	14·494	15	7
3	21·75	−·009	21·741	22	7
4	29 00	−·012	28·988	29	7
5	36·25	−·015	36·235	37	8
6	43·50	−·018	43·482	44	7
7	50·75	−·021	50·729	51	7
8	58·00	−·024	57·976	58	7

The column A′, is simply A brought up to integers; and it is evident, that to

* Discount and Interest Tables. London, 8vo., 1823.

† Savings' Bank Assistant. London, 12mo., 1829.

* Many banks compute interest by the calendar month, a method perhaps originally adopted from an idea of greater simplicity. This is not correct, unless imperfect tables and awkward forms of account are employed. Computation by the week is certainly most fair to the depositors. One of the merits of the kind of Table discussed in this paper, consists in its being equally easy to construct and to use, whether the rate of interest be integral or fractional.

† I avow myself an *idle* calculator, if industry consists in using a great many more figures than are absolutely necessary.

continue such a column *ad infinitum*, nothing more is necessary than to write the figures 8, 7, 7, 7 below each other on the right-hand edge of a card, and to proceed by the constant addition of those four figures in rotation. Let this be done *in pencil*, to the extent of 332 terms.*

We have next to ascertain what terms of this last series would be affected by the subtractive values of column B, if it were actually formed. It is clear, that to the extent of the 332 terms, the correction can never exceed unity, for $\cdot003 \times 332 = \cdot996$ only) and that the abstraction of 1 will first occur in those terms, in which the decimal of col. A would be ·250, next in those of ·500, and afterwards in those of ·750. These decimals always recurring at every fourth line, it will at once be seen, that

$$\cdot250 \left\{\begin{array}{l}\text{occurs in those lines the}\\ \text{numbers of which are of}\\ \text{the form}\ldots\ldots\ldots\ldots\end{array}\right\} 4n+1\dagger$$

$\cdot500$ .... $4n+2$

$\cdot750$ .... $4n+3$

Suppose ·250 a value to which the series in col. B has reached: divided by ·003, it gives 83 +, and the first number above 83 which has the form $4n+1$ being 85, shows that the 85th line is the first at which the application of -1 is to be made. Make a mark on that line, and on every 4th line subsequently, to the end.

In like manner, $\cdot500 \div \cdot003 = 166+$, and the first number after 166, of the form $4n+2$, is 170. Mark therefore the 170th and every 4th following line.

Again, $\cdot750 \div \cdot003 = 250$, and the first number *at*‡ or after 250, of the form $4n+3$, is 251. Mark, therefore, the 251st and every 4th following line to the end. The whole of the remaining terms, except those whose numbers are of the form $4n$, will now be marked.

Write over with ink the series already set down in pencil, observing to *diminish by unity all those terms against which a mark has been placed;* we shall then have the required series, identically that which would have been obtained with far less ease by the ordinary process.

To form the second series of 332 terms, write 2406 above the lower edge of a card, and apply it successively to the term of the first series. But what is to be done with the remaining decimal ·004? Can that have no influence on any of the integers of the 2nd series? This question I proceed to answer.

In cases where the original decimal of col. C is from ·997 to ·000, both inclusive, this ·004 might, under certain conditions, cause an increase of unity. Now as all the values of B must be multiples of ·003, the only combinations of A with B to produce either of the above decimals in C would be these,

$\cdot250-(\cdot003\times\ 84)=\cdot998..\ [\ 84=4n+0]$
$\cdot500-(\cdot003\times167)=\cdot999..\ [167=4n+3]$
$\cdot750-(\cdot003\times251)=\cdot997..\ [251=4n+3]$
$\cdot750-(\cdot003\times250)=\cdot000..\ [250=4n+2]$

And that any of these four combinations may exist, the lines on which the ·250, &c., are found must agree in form with those of the multipliers 84, 167, &c. Thus it is known that the first, second, and fourth of the above combinations do not occur, and that the third *alone* is to be regarded. The sole effect, therefore, of the decimal ·004, upon the 2nd series, is to cause an increase of unity in the 251st term of that series, and in no other instance.*

To the above series of numbers (which represent principal multiplied by time) are to be annexed the corresponding interest sums, being each progressive penny up to 2*l.* 15*s.* 4*d.*

The series of 664 terms will probably be sufficient in practice. For the few cases which go beyond it, subtract 4812 from the argument, and find the interest due to the remainder, which augment by 2*l.* 15*s.* 4*d.*

In writing out the table for use, it will be most convenient to make each column consist of 69 lines instead of 83, since reference will be facilitated by making 500, 1000, 1500, &c., the limits of the successive columns.

J. W. WOOLLGAR.

Lewes, October 25, 1844.

Addendum.—I intended to have forwarded a Table to illustrate my theory of Savings' Banks; but I find that a very

* A small table of the multiples of 290 should be formed by which to check each 40th term of the series.

† A number is said to be of the form $an+b$, when upon being divided by a, it leaves a remainder b.

‡ In the two former cases the decimal, if taken as a whole number, could not be divided by 3 without remainder.

* A third series may be formed (if necessary) from the second, by a repetition of the process; and by applying the above principle, it will be found that in such 3rd series the 85th term must be augmented by unity.

minute return has been directed to be made to Parliament, which will furnish more accurate data than those I now possess; and therefore the table is withheld for the present.

THE LIGHTING OF MINES.

Sir,—Mr. Cumberland's suggestion for lighting mines, described in your 1106th Number, (supposing it to be possible to adopt it,) would create a source of danger which he probably has overlooked. The carburetted hydrogen, or fire damp of mines, is not the gas to the danger of which miners are most frequently subjected: but there is another gas, the carbonic acid, or black damp, to detect the presence of which, a lighted candle, or lamp is indispensably necessary, and so long as the light will burn the miner may feel assured, that he is breathing a safe atmosphere; deprive him of this excellent and sure monitor of danger, and we should have fatal accidents as frequent from the suffocation of the latter, as from the explosions of the former gas.

It is evident, however, that such a method of lighting mines could not emanate from a person practically acquainted with them, or who is aware of the numerous and tortuous passages common to all mines. Suppose such a plan to be attempted—how are the minerals and miners to pass to and fro, without constantly intercepting the rays of light, passing from one reflector to another, and of course, for the time, placing all the mine beyond the intercepting body in total darkness—or how is the light to pass through the numerous doors, necessary for diverting the air into the various parts of the mine, unless they be made of plate glass?

Mr. Cumberland, and all who feel interested in the safety of the poor miner, may rest assured that there can be no plan so simple as, or which can supersede the necessity of, perfect ventilation, and that mine can never be said to be well ventilated where the constant use of the Davy lamp is necessary for the workmen. That man will be a benefactor to his species, who can successfully introduce the "long work" system of getting coal into the collieries of the north of England. By that plan the current of air would be constantly conveyed along the working face of the coal, and take with it the inflammable gas as it issued from the crevices, whilst the superincumbent strata would fall after the removal of the coal, and fill up those magazines, where under the present system the fire damp accumulates, and which renders the after-getting of the pillars so exceedingly dangerous. The Davy lamp may be perfectly safe so long as it is clean, and in good order, but it is a lamentable consideration that any man, however prudent and cautious he may be himself, must jeopardise his life, to the casualties or follies of one hundred others, over whose actions he cannot have the slightest control.

I am, Sir, your obedient servant,

B².

October 25, 1844.

THE ATMOSPHERIC MARINE ENGINE.

Sir,—Referring to the letters of your correspondent "Curve" in the *Mechanics' Magazine*, I must offer it as my opinion, (an opinion in which I am not singular,) that the statements he has yet advanced in favour of atmospheric engines, whether as applied to the purpose of giving motion to machinery or to the propelling of vessels, are by no means satisfactory. I apprehend, that the engineers of Cornwall would be strangely surprised at any proposal to adopt them. It seems superfluous to say, that the minimum consumption of fuel and maximum power produceable from it, are considerations of no less importance, in the case of steam-engines, when applied to turning machinery, than (may I not say of *even more importance?*) when applied to the propulsion of ships and vessels.

Those extremely undefined results, on which your correspondent seems a good deal to depend for the agreement of the public with him, in his opinions respecting the superiority of the engines referred to, are, in my humble judgment, the least conclusive he could have advanced; as it is not denied I believe by those who have given close attention to this interesting subject, that the speed of steam vessels of the same size, but built of slightly different forms, and propelled by engines exactly alike, may yet be very different. Still less can any safe conclusion be drawn, as regards their superiority, from such trials as those which "Curve" has referred to, between the new steamer,

the *Wonder*, and other vessels very differently circumstanced, and employed in their regular traffic; the *Wonder* in all cases, as it would seem, having been run light, and, it may be presumed, with the sole purpose of exhibiting her highest rate of speed, without reference to economy of fuel.

Considering the attention that has been drawn to the subject of atmospheric engines, by the statements of "Curve," who appears to have an acquaintance with steam engines, and that his opinions are so much at variance with that of the majority of those best informed upon the subject, I may be excused for calling on him through the medium of your pages, to give a well authenticated indicator performance, with the consumption of good coal, taken for a sufficient length of time, the size of cylinder, and length of stroke, and the exact weight of the engines with water in the boilers. Nothing short of this information will, I apprehend, afford the means by which persons competent to judge of the subject can form a correct opinion of their merits, when compared with the best constructed direct engines, such as oscillating engines, steeple engines, &c.

I am, Sir, your obedient servant,

A Cylinder Lid.

London, October 24, 1844.

CURIOSITIES OF OLD BOOKS, WITH A GOOD MANY QUERIES.

Sir,—In "Sturmy's Mathematical and Practical Arts," published by Cotes, London, A.D. 1669, will be found paper models of some curious nautical instruments. One is called a "Nocturnal," and consists of a square plate or dial, above which is a "rundle," or round plate, with an index upon its edge, and above this is a long index or pointer; the two last mentioned are moveable round the centre of the former; the plates contain the requisite circles divided and numbered. The use of this instrument is to ascertain the hour of the night by the stars Polaris and Kochab in Ursa Minor. There is another, called an "Instrument of the stars." This consists of a square plate and a "rundle;" upon the rundle the principal fixed stars are laid down according to the order of their right ascension. The use of this is to ascertain the hour when any star is upon the meridian, and *vice versa*. After pasting the plates, rundles, and pointer, upon stiff card-paper, I fastened the two instruments back to back, with a hollow axis passed through the whole, so that, whilst observing the pole star through the hole, the index and rundles may be turned upon the axis. It will be readily seen, that the instrument thus put together presents two faces; and, like all wearers of two faces, it will deceive you, should you forget that the months and signs of the ecliptic are placed according to old style.—*Query*—Are there any modern instruments of this description to be had in London?

The next object of interest which I have to notice is an old "Arithmetis," of 382 pages, with a table of 7 figure logarithms, title-page absent. The introduction, besides the ugly term "Duplasuperdupartienstertia," contains several more of the same family. It is rich also in a treatise upon artificial versifying, in which is given eleven small tables of letters for the construction of hexameter and pentameter Latin verses; the author maintains that 30 volumes as big, or bigger than Virgil, may be composed from the hexameters alone, "all good Latin, true verse, and perfect sense!" Here is a field, indeed, for authors, printers, and publishers! There are two lines given by way of example. The hexameter runs thus, "Pessima bella domi monstrabunt verbera nigra;" and the pentameter thus, "Ardua concludunt verba molesta mihi."—*Query*, What is the Queen's English—or Prince Albert's, if you like—for this Latin?

The same old book contains also a geometrical demonstration of the rule for multiplying £ *s*. *d*. by £ *s*. *d*., of the form 2*s*. 6*d*. × 2*s*. 6*d*. – 3¾*d*., when L is the integer; the diagram is equally applicable to feet, inches, and parts.

Although the "Bok" contains no treatise on algebra, there are given 99 problems, without answers, in that science; a goodly collection of exercises for an algebraist. Some of these, however, may be solved by a slight mental effort; whilst others, I guess, would be found posers for even a clever algebraist. Amongst the former class, is the problem of the ladder between two towers of unequal height. I recollect that, after a trial at this with pencil and paper, during a full hour by candle-light, without suc-

cess, I went to bed, where, in total darkness, and in spite of Morpheus and Queen Mab, I soon discovered where the foot of the ladder should be placed. There is a well-known rule for finding the segments of the base of a triangle, when the three sides are given; this same rule is applicable to the ladder and tower problem; and I am sure none of your corrospondents, at page 205, Vol. xii., will be at a loss, by the aid of this rule, in determining mentally the place of the foot of the ladder. I believe they none of them hit upon this method. *Query*—Is it possible that such an application of the rule can have escaped the notice of mathematicians?

The arrangement of the nine digits into a square, so that any row of three figures shall always make 15, is given as an algebraical problem. Now I recollect when a schoolboy, and during the Midsummer vacation, feeling the want of some amusement, and having neither shuttlecock nor marbles, I took it into my head to have a trial at the magic squares, and succeeded perfectly in filling up all those from 3 times 3 to 10 times 10; this I did by dint of severe trial alone, not being in possession of any rule to assist me.—*Query*—Is it possible to arrange these squares with comparative facility by the aid of algebra?

The title page of this Arithmetic is lost; but, from the particulars I here give about it, perhaps some correspondent will be able to favour me with the name of the author, and the date of the last edition. These books were my first instructors in the higher branches of arithmetic, and in trigonometry; and the chief object of this communication is to raise a tablet to the memory of their authors in the everlasting pages of the *Mechanics' Magazine*. Captain Samuel Sturmy was a Bristol man.

There are many correspondents of your Magazine well acquainted with mathematical books and instruments, both ancient and modern; and I should reckon him a very clever man, and a most excellent friend, who would be kind enough to give an answer to this string of queries. If, however, the labour is too much for one man, I have no objection to a division of it; "Every man to his station, and the cook to the foresheet," as the boatswain pipes it. Yours truly,

J. LOOSE.

Wolverhampton, Oct. 18, 1844.

Note.—Your correspondent "S," in his papers upon the "Mechanical Square of Numbers," in your 39th volume, gives a very good rule for filling up the odd squares.—*Query*—Has he yet discovered a rule for filling up the even squares?

THE MODERN ARCHIMEDEAN SCREW.

Sir,—I hope you will not object to add to the many excellent contributions which have, at different times, appeared in your pages, to the *History of Screw Propelling*, the following authentic particulars respecting the invention of the Archimedean screw, which recent experiments have shown to be the best which has yet been invented. They are extracted from a letter to the *Times* from Major E. P. White, of the Royal Staff Corps.

"The facts of the case are simply these:—About 23 or 24 years ago the idea of converting the Archimedean screw into a propeller for vessels of burden when fixed in the dead wood and worked by self-acting machinery from the middle or upper deck of a ship, first occurred to the late Captain Duvernet, of the Royal Staff corps, and after much labour and many contrivances he constructed a model, the shell of which I can produce. He frequently tested his invention on the Royal Military Canal, in presence of officers of rank and many inhabitants of Hythe, of which place Mr. Smith is a native, and where his family still reside. After Captain Duvernet had satisfied himself of the utility of his plan he made a new and more perfect model, and presented it to the Duke of Clarence, then Lord High Admiral of England. Shortly after he was sent on duty to Ceylon, where he fell a victim to the ravages of the climate; and I heard no more of the screw propellers until about five or six years ago, when I was informed by Colonel Arnold, now Major-General, of the Royal Engineers, that Mr. Smith had submitted to his inspection in Hythe a model of it. I then told the General that the invention of the Archimedean screw propellers was the property of the late Captain Duvernet, of the Royal Staff corps, and that I could show him a model of it constructed by that clever officer about the year 1820.

"It will be seen by the foregoing brief statement that I have no personal interest whatever in the screw propeller, nor any object in view beyond that of doing justice to the merits and abilities of a deceased brother officer, and the hope that should this meet the eyes of his children they will see that the exertions of their father to benefit his country are not yet lost sight of."

I am, Sir, yours obediently, JUSTUS.

NICHOLSON'S COMPOUND WEDGE FOR VARYING THE DISTANCE BETWEEN ROLLERS IN GRINDING, CRUSHING, PRESSING, AND OTHER SIMILAR MACHINES.

[Registered under the Act for the Protection of Articles of Utility. Mr. N. Nicholson, of Newark, Agricultural Implement Maker, Inventor and Proprietor.]

Fig. 1.

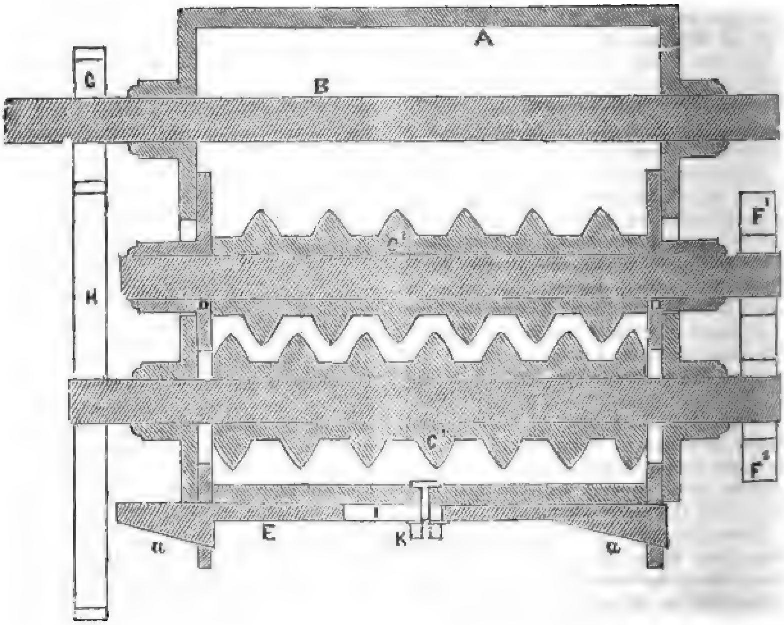


Fig. 2.

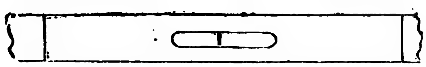
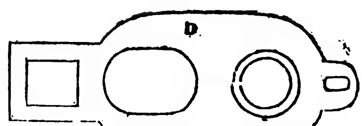


Fig. 3.



This is a most ingenious and skilful modification of the power of the wedge, and applicable to a very numerous class of machines. Among these, there is none, perhaps, so calculated to show the great advantages derived from it, in facility of adjustment and range of power, as the oil-cake mill; and in the accompanying drawings it is accordingly represented as applied to a machine of this description.

Figure 1 is a horizontal section taken through the centre of the roller shafts, &c. A A is the external frame work of the mill; B the driving axle upon which the fly-wheel and driving handle are fixed. C^1 C^2 are the rollers or breakers. The ends of C, are inserted into bushes formed in the external frame A A; the bushes of the other C^2 are fixed in moveable pieces, D D, one at each side of the

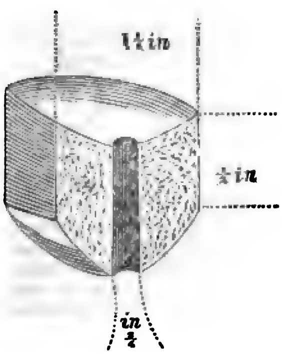
frame, A A. The moveable pieces or shifting bushes are prolonged outward at the front of the machine passing through the holes in the frame, A A. E is the compound wedge. The wedge pieces, *a a*, on each end are exactly alike. The wedge is passed through holes in the ends of D D, and as it is driven in, or slackened, the crushing rollers are brought closer to or more apart from each other. F^1 F^2 are two deep-toothed pinions; G, a pinion on the driving shaft, which communicates the motion to the roller C^1 by the toothed wheel H.

Fig. 2 is a side view of the compound wedge, showing the slot I, through which a bolt *k* is passed, by which it is fixed when brought into proper position.

Fig. 3 is a side view of one of the shifting pieces D.

REMARKABLE CASE OF EXPLOSION OF HARDENED STEEL.

The following figure represents a fragment of a step for an upright shaft, made of round steel $1\frac{3}{8}$ inch in diameter, with a hole $\frac{1}{8}$th of an inch in diameter passing through the centre.



Twelve pieces were cut from the bar, and after being finished in the usual manner, were tempered separately, each being heated to a cherry-red heat, and plunged in water until perfectly cold; they were then laid aside, where the temperature was at sixty-five degrees. In about an hour, one of them burst into two parts, with a report as loud as that of a pistol; one of the pieces was thrown about 12 feet, the other struck the wall of the shop 2 or 3 feet distant. Of the whole number made, eight were broken at intervals of several days, but without any violent explosion. Examined with the microscope, the steel appears distinctly radiated, or fibrous, to the depth of a line from the external surface, while the inside is granular, but without the slightest appearance of flaw, or want of actual contact of the particles at the point ruptured, previous to the explosion. The specific gravity of the bar-steel is 7·825; that of the fractured pieces 7·850.

The cause of the fracture is, probably, the same as is observed in the glass toy called Prince Rupert's drops, made by pouring melted glass into cold water; the outside is suddenly contracted, while the particles in the interior, cooling more gradually, assume a different crystaline form, and burst asunder as soon as the cohesion of the external coating is destroyed.—*John M. Batchelder.*—*Franklin Journal, August*, 1844.

LIPSCOMBE'S SUBSTITUTE FOR THE CRANK.

Sir,—I beg to be allowed to make a few remarks upon a communication which appeared in your pages last month, being a description of and dissertation upon Lipscombe's patent substitute for the crank, bearing the signature of "N."

Your correspondent proves (?) by what he calls *very simple* experiments, (they are *very simple indeed*, Mr. Editor,) "that the crank does not transmit even so much as one half the power expended against it." And to enforce his argument, in a more energetic manner, he gives us a diagram of a common crank, showing its positions on its centre, and at half stroke, the supposed moving power being 100 lbs., hanging from its pin.

Let us first take its position when on the centre. "N" says, "It will at once be seen that the crank has not the slightest tendency to move either to the right or to the left; this clearly proves that the whole gravitating force of the weight is exerted in pulling the crank shaft against its bearings, thereby showing a *misdirection* of force of 100 lbs." What does "N" mean by a "misdirection of force?" Does he mean to say, that if the crank is placed on its centre, and a weight, or the pressure of the steam, which is the same thing, applied to it in that position, that the whole amount of the weight so placed, or the whole amount of steam at that time in the cylinder, is wasted?

I ask "N" how, if the weight so suspended, or the piston against which the steam is acting, does not move, (which is

manifestly impossible in this position,) how is it that its power can possibly be wasted?

"N" might as well say that so long as a boiler, containing steam at any given pressure, is kept closed, the amount of steam so enclosed is wasted, because it *presses* upon the surface of the boiler. So long as no motion is given to the crank, it is impossible that the power applied can be wasted.

"N" also goes on to tell us that it is only when the crank is exactly at half-stroke, that no misdirection of power takes place. "N" will, perhaps, pardon me when I inform him, that if power is wasted when the crank is on its centre, it is most certainly also wasted when at half-stroke. No one who knows the least upon the subject, or who has studied the theory of *virtual* velocities, can for a moment doubt this.

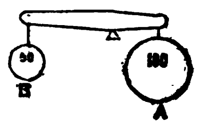
When the crank is on its centre, its motion, with regard to that of the piston, is *infinite*, while the latter is *nothing*, and when at half-stroke the velocities of the two, *for an instant*, coincide. In the first instance, no force being delivered to the crank, it is clear (*e nihilo nihil fit*) that none can by any possibility be given out, and it is equally clear that none can therefore be lost. In the second instance, the motion of the crank being exactly equal to that of the piston, it is also clear that none can be lost or *misdirected then*. And if "N" examines it throughout all its positions, he will find that in every position the motion of the crank, with regard to the motion of the piston or moving power, will always bear the same ratio to the *efficient leverage* at that instant.

This plain reasoning does not seem at all to agree with "N's" logic, who either does not understand, or will not recognise, our acknowledged laws of "power and speed." An extremely easy way of assuring himself of the truth of my propositions, is to take a toothed wheel and pinion, whose proportions are similar to those of the stroke of the piston, to the distance which the crank travels in the same time, or as 1 : 1 : 57. Let him fix these wheels in suitable bearings, and hang a weight to the circumference of the larger wheel, and see what weight will be required to balance it upon the circumference of the pinion or smaller wheel; I rather think he will find it to be exactly in the same ratio as the diameter of the wheels, of course allowing somewhat for friction.

As "N" seems to be fond of the rack and pinion motion, let him further attach a rack so as to gear with the larger wheel, and to this rack let him add any weight sufficient to cause the pinion to revolve. He will find that although power is lost in the ratio of 1·57 to 1, *speed* is gained in precisely the same ratio. I know of no method more practically easy than this, for giving him a proper idea of the laws of "virtual velocities."

In his diagram, fig. 3, he shows us a crank placed at an angle of 45° with the moving power, and because he finds that 100 lbs. hung to the crank pin in that position will only balance 50 lbs. hung on an imaginary crank placed at right angles, or at an angle of 90° with the moving power, and he contends that the remaining 50 lbs. are lost or expended in pulling the crank shaft against its bearings. The very plain experiment which I have above recommended will prove the fallacy of his conclusions.

His theory respecting the loss by the friction so generated, is so extremely ridiculous that it scarcely merits an investigation. However, to put the matter in its plainest form, let us suppose the lever A B, in the following diagram, with the 100 lbs. weight near the fulcrum, or at the shorter end, and the 50 lbs. weight at the longer end, to represent the same combination as his fig. 3, which it manifestly must do, as the two positions in which he shows the weights acting upon the cranks are neither more nor less than the same weights acting upon a long and a short lever as represented.



Now does "N" mean to say, that because the 100 lbs. weight at A will only balance 50 lbs. at B, that the remaining 50 lbs. is wasted, partly by *misdirection*, and partly by friction upon the fulcrum, which is situated in a similar manner to the crank shaft in his diagram? Nothing of the sort; he will find that the ratio of speeds of the two weights when in motion, is exactly in proportion to their respective weights, that is, in the present case, as 50 to 100.

With reference to his sketch of the rack and wheel motion, he says, "no misdirection of force can take place, as is fully proved by the weight of the rack (100 lbs.) balancing a weight of 100 lbs. hung upon the opposite side of the wheel." But, I ask "N" what is the ratio of speed of the rack, and the weight upon the circumference of the wheel —is it not exactly the same? Let him compare it with the crank motion, and mark

the difference of the speeds; the result can hardly fail to convince him of his mistake.

His theory of waste by the connecting rod has been so often refuted that I will not trespass upon your attention by contradicting it.

Supposing, for the sake of argument, that Mr. Lipscombe's substitute were more economical than the crank, in what is it superior to "Shuttleworth's substitute?" patented in 1839, and a description of which has appeared in a former volume of your Journal. In fact, I could point out at least a dozen others which are at least equal, and many of them much superior in point of simplicity to Lipscombe's.

Allow me also to add, that before "N" condemns the conclusions of such men as Mr. J. S. Russell, he must first perfectly understand the laws of *statics* and *dynamics*, which he evidently does not, as he most wofully confounds the two.

I will, however, take leave of "N" by promising him that so soon as he has an engine fitted, according to the principle of Lipscombe's patent, which engine shall perform three-fourths more work than an engine with the common crank, both being in every other respect precisely similar, I will travel to the Land's End, if required, to see so great a phenomenon, which, however, I have very little faith will ever happen.

Apologizing for trespassing so far upon your columns,

I beg to remain, yours very truly,

W. J.

Manchester, October 16, 1844.

MANUFACTURE OF SODA AND POTASS FROM SEA-WATER.

M. Ballard read a paper recently at the Paris Academy of Sciences, on the means of extracting from sea-water the sulphates of soda and potass in sufficient quantity for all the purposes of commerce, without having recourse to the present expensive process. Hitherto it has been found impracticable to obtain the sulphate of soda from sea-water in abundance, but M. Ballard has been able, from an evaporating surface of 200 hectares (500 English acres), to obtain 2,500,000 kilogrammes in one year. We extract the following from M. Ballard's paper, showing the causes which have hitherto prevented such results, and his means of remedy:—

"When two salts differ in their acid and their basis, and a double decomposition is possible, the presence of the first may favour the solubility of the second. When these two salts have, on the contrary, the same acid and the same basis, and the double decomposition is no longer possible, the same phenomenon does not take place. The solubility of one of the salts is diminished by the presence of the other, except in the case of the formation of a double salt. Thus, the hydrochlorate of magnesia impedes the solubility of sea salt, because it is a hydrochlorate, and that of the sulphate of magnesia, because it is a salt of magnesia. It favours, on the contrary, the solubility of sulphate of soda, because, probably, in this case, the double decomposition takes place. The solubility of the sulphate of soda is even diminished by the presence of the sea salt, because it is a salt of soda. The solution of the problem is simple. Since the hydrochlorate of magnesia impedes the solubility of the sulphate of magnesia and the chlorurate of sodium, between which the decomposition is to be effected, and, on the contrary, favours the solubility of the sulphate of soda to be precipitated, it must be driven off. Since sea salt impedes the solubility of sulphate of soda, and favours the precipitation of the product to be isolated, a further quantity must be added. To extract from the water the sulphate of magnesia, to eliminate the chlorurate of magnesia, and to add sea salt to excess—such is the process to be carried on."

M. Ballard adds that the sulphate of soda thus obtained is hydrated, but pure; it does not contain sulphate of magnesia, and is free from the excess of acid and the proportions of iron which are frequently found in the sulphate of soda of commerce.

ELECTRICAL CONDUCTORS.

Sir,—Mr. Baddeley really writes as seriously about insulation as if he had a mighty phalanx of electricians to support his views. Are you aware, Mr. Editor, that not one of those electricians whom I quoted in my last, gives one word of instruction respecting insulation, although they all give the *essentials* of lightning-rods? I merely mention this, that your readers may not be misled. And what *sort of insulation* can that be of Mr. Baddeley's, wherein the uninsulation advised by so many philosophers is included? Other hints against the conductors, thrown in here and there throughout his correspondence, are so evidently the result of imperfect acquaintance with the subject, that I leave them.

Why does he not, for the satisfaction of your readers, furnish them with his *authorities* for the peculiar views he adopts? for surely he must allow, that with "Wm. Baddeley" on the one hand, and so many sound philosophers on the other, the balance cannot but preponderate one way.

As I do not feel disposed either to waste

my own time, or to intrude upon your columns again on this matter, let me anticipate any further lucubrations of his, by advising him, before he adds any other to the list of his propositions, first to consult the standard authorities.

With many thanks for your kindness, in granting me so much space during this correspondence, and assuring you that it was only for the sake of your readers, that I have thus ventured several times to intrude,

I beg to remain, Sir, yours faithfully,

CHARLES V. WALKER.

Westbourne-green, October 28, 1844.

After so much has been said in our pages on the subject of the Royal Exchange Conductor, it may not be out of place to add a description of what it really is. For the authentic particulars which follow we are indebted to a letter from Mr. Walker, which appeared in the *Times*, on the day after the Royal opening.—ED. M. M.

"The lightning conductor of the Royal Exchange has been erected essentially as a conductor of lightning; it is not placed thereunder the idea that it will avert a lightning flash by draining the cloud of its electrical contents; nor will it invite a lightning-flash by any attractive power inherent in itself; but it is there, ready to receive any flash that may strike it, and to conduct it in safety to the earth. It is presumed that the time may come when a cloud shall pass over the tower at the precise moment when its electrical contents are in such a state of 'tottering equilibrium,' that its inductive action on the conducteous bodies there present will be sufficient to overthrow this equilibrium and cause the discharge. The apex of the conductor is, therefore, so presented to the cloud, as to be more accessible to the flash than any other conducteous body; and with the broad fact before us, that the flash is journeying onward to the earth, and will arrive there by the course opposing least resistance, every precaution is taken not merely that the conductor shall be the path presenting least resistance, but that it shall be a path large enough to convey away any lightning flash whatever. In other words, we presume that the conductor may one day be struck by lightning; and knowing that the object of the lightning is to reach the earth with the least possible opposition, we provide for it a path, not only efficient in itself, but likewise more efficient than any other vicinal path or paths.

"The conductor is a copper rod three quarters of an inch in diameter—a size more than sufficient to conduct safely the largest lightning flash; for experience has not furnished us with any cases wherein a mass of copper of only half an inch in diameter has been melted by lightning; while many instances are extant of heavy discharges being safely conducted by smaller rods. It commences with a rod of copper, tipped and pointed with platinum, erected on the back of the grasshopper vane immediately over the spindle; and terminated in a furcated form within a pit sunk near the base of the tower. As a lightning conductor is a most dangerous appendage unless its base is very effectually connected with the subsoil, the greatest attention has been paid to this point. The pit was sunk through the concrete until the native gravel was fairly entered; the furcated terminating portion was then attached, so as to reach to the bottom of the pit; a ton or two of the graphite, obtained from gas retorts, was broken small, and thrown into the pit, so as completely to bury the furcations. I may mention that this material, besides being indestructible, is an excellent conductor of electricity; and that it is employed in order to present as large a conducting surface to the soil as possible, and so to facilitate the escape of the charge, and thus make the conductor in every respect the path opposing least resistance. The pit was then filled up.

"As the supply-pipe by which the Exchange is furnished with water passes at no great distance from the spot where the conductor enters the court-yard, the pipe has been connected with the conductor by means of a copper rod, and thus the whole mass of the water-pipes throughout London constitute an infinitely extensive discharging train. So perfect is this discharging system, that I could have contented myself without the pit of graphite, had I not looked through the vista of years to the time when these water-pipes might be removed or altered. The workmen would detach the connexions, and if unaware of its nature, which is more than probable, they might replace the pipes without attending to the apparently useless rod of copper.

"The course of the conductor is not obvious to the passerby, for I have not cared unnecessarily to create an eyesore on the architecture of the tower. I have, therefore carried it within the tower from the vane to the belfry, and have then led it out, so as to pass over the parapet at a level with the roof of the building, and to descend into the inner court at the right hand on entering. Throughout its course the conductor is a perfect fixture, being secured to the wall by copper staples a few inches in length.

"There is one question which always arises in respect to lightning conductors,

and in answering this another essential feature will be recognized. Is it possible for any portion of the flash to leave the conductor? Yes, in extreme cases it is just possible. When? Whenever a path is at hand which, with the conductor (during the whole or a portion of the rest of the course), presents less resistance to the particular flash in question than is presented by the conductor alone; in other words, the clock-room and the belfry contain large masses of metal, which might, in an extreme case, relieve the conductor in this part of its course of a part of the charge. This remote contingency must, therefore, be provided against. Now, lightning is mainly a destructive agent during its transit from metal to metal, through stone and wood, and such like bad conductors; while travelling in capacious masses of metal it is perfectly harmless; therefore, in order to prevent its attaining to these masses of metal through the intervention of bad conductors, the clock and the bells are respectively connected with the lightning conductor by a series of copper rods, so that, should the case ever occur in which a portion of the charge should claim the supplementary path presented by these necessary appendages to the tower, it will pass innocently to them in the first instance, and from them afterwards, without any flash or explosion being made manifest. In like manner, where the conductor passes over the parapet, near the gutters and water-spouts, a copper rod is led away to the nearest gutter, and secured to the metal of which it is constructed. By these means the whole of the metalwork about the building is included in the general system; and no supplementary or side path is open to the flash that is not in perfect metallic connexion with the rod itself."

THE BRITISH ASSOCIATION—YORK MEETING, 1844.

[Selected from the Reports of their Proceedings in the *Athenæum* and other journals.]

(Continued from page 282.)

Progress of Photography.

A paper was read "On the Amphitype, a new Photographic process," by Sir J. HERSCHEL.

Paper proper for producing an amphitype picture may be prepared either with the ferro-tartrate or the ferro-citrate of the protoxide or the peroxide of mercury, or of the protoxide of lead, by using creams of these salts, or by successive applications of the nitrates of the respective oxides, singly or in mixture, to the paper, alternating with solutions of the ammonia-tartrate or ammonia-citrate of iron,* the latter solutions being last applied, and in more or less excess. Paper so prepared and dried takes a negative picture, in a time varying from half an hour to five or six hours, according to the intensity of the light; and the impression produced varies in apparent force from a faint and hardly perceptible picture, to one of the highest conceivable fulness and richness both of tint and detail, the colour in this case being a superb velvety brown. This extreme richness of effect is not produced except lead be present, either in the ingredients used, or *in the paper itself.* The pictures in this state are not permanent. They fade in the dark, though with very different degrees of rapidity, some (especially if free tartaric or citric acid be present) in a few days, while others remain for weeks unimpaired, and require whole years for their total obliteration. But though entirely faded out in appearance, the picture is only rendered dormant, and may be restored, changing its character from negative to positive, and its colour from brown to black (in the shadows) by the following process:—A bath being prepared by pouring a small quantity of solution of pernitrate of mercury into a large quantity of water, and letting the sub-nitrated precipitate subside, the picture must be immersed in it (carefully and repeatedly clearing off all air bubbles), and allowed to remain till the picture (if anywhere visible) is entirely destroyed, or if faded, till it is judged sufficient from previous experience; a term which is often marked by the appearance of a feeble positive picture, of a bright yellow hue, on the pale yellow ground of the paper. A long time (several weeks) is often required for this, but heat accelerates the action, and it is often complete in a few hours. In this state the picture is to be very thoroughly rinsed and soaked in pure warm water, and then dried. It is then to be well ironed with a smooth iron, heated so as barely not to injure the paper, placing it, for better security against scorching, between smooth clean papers. If, then, the process have been successful, a perfectly black, positive picture is at once developed. At first it most commonly happens that the whole picture is sooty or dingy to such a degree that it is condemned as spoiled, but on keeping it between the leaves of a book, especially in a moist atmosphere, by extremely slow degrees this dinginess disappears, and the picture disengages itself with continually increasing sharpness and clearness, and acquires the exact effect of a copper-plate

* So commonly called, and sold as such, but their chemical names would be ferro-tartrate and ferro-citrate of ammonia.

engraving on a paper more or less tinted with pale yellow. The best and most uniform specimens have been on paper previously washed with certain preparations of uric acid, which is a very remarkable and powerful photographic element. The intensity of the original negative picture is no criterion of what may be expected in the positive. It is from the production, by one and the same action of the light, of either a positive or a negative picture, according to the subsequent manipulations, that Sir John Herschel has designated the process by the term *amphitype*—a name suggested by Mr. Talbot, to whom he communicated this singular result. To this process, or class of processes, Sir John proposes to restrict the name in question, though it applies even more appropriately to the following exceedingly curious and remarkable one, in which silver is concerned. At the last meeting Sir John announced a mode of producing, by means of a solution of silver, in conjunction with ferro-tartaric acid, a dormant picture brought out into a forcible negative impression by the breath or moist air. The solution then described, and which had, at that time, been prepared some weeks, has retained its limpidity and photographic properties quite unimpaired during the whole year since elapsed, and is now as sensitive as ever,—a property of no small value. Now, when a picture (for example, an impression from an engraving) is taken on paper washed with this solution, it shows no sign of a picture on its back, whether that on its face be developed or not; but if, while the actinic influence is still fresh upon the face (*i. e.* as soon as it is removed from the light) *the back* be exposed for a very few seconds to the sunshine, and then removed to a gloomy place, a *positive picture, the exact complement of the negative one on the other side*, though wanting, of course, in sharpness if the paper be thick, *slowly and gradually makes its appearance* there, and in half an hour or an hour acquires a considerable intensity. The "ferro-tartaric acid" in question is prepared by precipitating the ferro-tartrate of ammonia (ammonia-tartrate of iron) by acetate of lead, and decomposing the precipitate by dilute sulphuric acid.

When lead is used in the preparation of amphitype paper, the parts on which the light has acted are found to be in a very high degree *rendered waterproof*.

Mr. R. Hunt read a paper "On the Energiatype, and the Property of Sulphate of Iron in developing Photographic Images."

Some months ago Mr. Hunt discovered a new photographic process of great sensibility, to which the above name was given. It consisted essentially in the development of a dormant photographic image, formed on a paper prepared with succinic acid and nitrate of silver, by the deoxidizing power of sulphate of iron. Numerous failures have been since communicated to the author, which appeared to arise from the varying rates of solubility possessed by succinic acid obtained from different manufacturers. He now recommended that five grains of succinic acid should be put into a fluid ounce of distilled water, and allowed entirely to dissolve—that the salt and gum should then be added to this solution. Recent researches have, however, proved that this property of the sulphate of iron may be made available on *any photographic paper*. On paper merely washed with the nitrate of silver, good camera pictures have been thus obtained in a few minutes, and on papers prepared with the chloride of sodium, bromide of potassium, particularly the iodide of potassium, camera views are procured in less than a minute. Mr. Hunt exhibited a great number of specimens procured on the above and many other salts of silver—the most beautiful being procured on papers covered with the acetate, the benzoate, the citrate, and other organic salts of silver. These drawings were all fixed by washing with moderately strong ammonia.

Professor Grove called the attention to a new photographic process, by which pictures might be obtained by one operation. Papers were prepared with the iodide of potassium, nitrate of silver, and gallic acid, in the same manner as for Mr. Fox Talbot's calotype process, and then allowed to darken. The paper is again washed over with the iodide of potassium in solution, and dried. When required for use, it is to be immersed in a weak solution of nitric acid in water, and then exposed to light. In a very few minutes copies of engravings could be procured.

Influence of Light on the Chemical Compounds, and Electro-Chemical Action.

Mr. R. Hunt, after alluding to Sir John Herschel's experiments on the chloride of platinum, neutralized by lime water, from which a platinate of lime was precipitated by the influence of the solar rays, and to Dr. Draper's observations on the power which the solar beams had of imparting a property to chlorine of uniting with hydrogen under circumstances in which the same element kept in the dark would not unite, called attention to some experiments in which still more remarkable results had been obtained. If a solution of mineral chameleon be made in the dark it does not undergo any change for many hours—whilst a similar solution

will, if exposed to sunshine, precipitate heavily almost immediately. Sulphate of iron dissolved in common water, will, even in the dark, after some hours, give a precipitate of carbonate of iron—but if exposed to sunshine, this takes place instantly, and the weight of the precipitate, up to a certain point, is in both these cases a measure of the quantity of light to which the solutions have been exposed. A contrary effect to this has also been observed: if a solution of the bichromate of potash be mixed with one of sulphate of copper, and the mixture be set aside in the dark for twelve hours, the glass will become thickly coated with a chromate of copper, but a similar mixture exposed to the sunshine shows no such effect. Several solutions of the salts of silver were exposed to sunshine, whilst portions of the same solutions were kept in the dark. When small quantities of the sulphate of iron were added to these solutions it was found that those which had been exposed to sunshine gave a precipitate immediately, whereas those which had been preserved in the dark did not precipitate for some time. It has also been observed that bi-chromate of potash exposed to bright sunshine precipitated chromate of silver of a much more beautiful colour than a similar solution which had been preserved in darkness. A similar effect was observed in precipitating Prussian blue by a solution of the ferro-prussiate of potash which had been exposed to the sun—the colour being infinitely more beautiful than that thrown down by a solution which had not been so exposed. A solution of the iodide of potassium was put into a glass tube, the lower end being closed by a diaphragm; this was put into another vessel containing a solution of nitrate of silver, and a platina wire passed from one solution into the other. Such an arrangement being placed in the dark, a beautiful crystallization of metallic silver took place about the wire, but if placed in the sunshine this crystallization was entirely prevented. The attention of chemists was called to these results, which certainly show that the agency of the chemical rays must in future form an important subject of investigation, particularly when any delicate analysis is desirable.

Singular Effects of the Juxta-position of certain Colours under particular Circumstances.

Prof. WHEATSTONE, having had his attention drawn to the fact, that a carpet worked with a small pattern in green and red, when illuminated with gas-light, of viewed carelessly, produced an effect upon the eye as if all the parts of the pattern were in motion; he was led to have several patterns worked in various contrasted pairs of colours; and he found that in many of them the motion was perceptible, but in none so remarkably as in those in red and green; it appeared, also, to be necessary that the illumination should be gas-light, as the effect did not appear to manifest itself in daylight, at least in diffused daylight. He accounted for it by the eye retaining its sensibility for various colours during various lengths of time.

Sir DAVID BREWSTER stated that he and Prof. Wheatstone had brought to York separate communications on this experiment, with specimens of the rug-work in which it is best exhibited. Having seen Prof. Wheatstone's specimens, he had been induced to limit his communication to a few observations on Prof. Wheatstone's paper. When Sir D. Brewster came to York, he was not aware of the phenomena taking place with any other colour but *red* and *green*. Prof. Wheatstone had, however, shown him that *red* and *blue* answered equally well; and he had received letters from two ladies in Scotland, who had not only found that *red* and *blue* exhibited the phenomenon, but had both given the probable explanation of their doing so, by ascribing it to the *blue* becoming *green* in the *yellow* light of the candle.

In order to give an explanation of what has been called by some the *fluttering hearts*, from one of the colours having the shape of hearts, Sir D. Brewster mentioned an experiment for the purpose of showing that any fixed object will appear to move on the ground upon which it is fixed, when the light which illuminates it is constantly changing its position and intensity. This experiment consists in moving a candle rapidly in all directions, in front of a statue. The varying lights and shadows produce varying expressions, which give the appearance of life and motion in the features of the statue. Now, in the case of the vibrating hearts, the mixture of the *red* and *green*, whether seen as direct or as accidental impressions, produces successions of light and shadow which give the appearance of motion to the figure upon the *red* or *green* ground. This effect is greatly increased by that remarkable property of oblique vision, in which the retina increases in sensibility as the point impressed is removed from the *foramen centrale*. Hence, when we look fixedly at one of the vibrating hearts, it nearly ceases to vibrate, while the others, which are seen obliquely, vibrate with greater distinctness. The phenomenon has been stated to be invisible in daylight; but Sir D. Brewster mentioned that he had found that it took place in daylight, provided the coloured surface was illuminated from a small hole

in the shutter of a dark room. The experiment, indeed, he found to fail, even in candle light, if the illumination proceeded from a great number of lights, or from a mass of light producing a *quaquaversus* illumination like that of the sky. He referred also to the effects produced by coloured glasses, and mentioned some facts regarding the unequal absorption of the two colours, which, in drawing conclusions from such experiments, required to be attended to.

Size of Man.

A paper on this subject was read by Mr. W. B. Brent. It related to the stature and relative proportions of man, at different epochs, and in different countries. It embodied in tables the results of the measurement of some thousands of individuals, obtained from a variety of sources, though chiefly by the labour of the author, who suggested that statistical returns might be obtained in connexion with the census. He rejects the idea that tall men are deficient in mind, as hinted by Lord Bacon, and adduced instances of the contrary, and noticed the fact that the stature of the inmates of hospitals, workhouses, and prisons, is below the average. The average height of Englishmen is placed at 5 feet 7½ inches. The army returns range from 5 feet 6 inches to 5 feet 7 inches. The yeomanry, including a higher class, range from 5 feet 1 inch, to 6 feet 2 inches. The French conscripts, officially stated, give an average of 5 feet 4¾ inches, but Mr. Brent, from his own observation, would place it higher. The observation made by Prof. J. D. Forbes amongst the pupils of his own class, placed the Irish as the tallest, the Scotch next, and then the English. The Belgians appear to be of still lower stature. A fact was noticed, as having been brought to light by the researches made by Mr. Hutchinson, in which Mr. Brent had taken a part:—it was discovered that the amount of air which can be expelled from a healthy chest, after full inspiration, bore a certain ratio to the height of the individual, a certain number of cubic inches of air corresponding to every additional inch of stature.—(*To be continued.*)

NOTES AND NOTICES.

English Steam-engines in France.—Of the 229 steam-vessels possessed by France in 1843 (see the statement of the *Moniteur Industriel*, translated in *Mech. Mag.* of the 14th Sept. last), the engines of no less than 47 were supplied by one English house alone—that of Messrs. Miller, Ravenhill, and Co. "I should say, also," observes Mr. Miller, in a letter to a contemporary, "that those supplied by our firm to the Government have been adopted as a type for others, and they have just completed ten Post-office packets of 220-horses power each, for the Mediterranean service, (that is, between Marseilles and Constantinople and Alexandria,) the plans for the engines of which ten vessels supplied by the Government to the different manufacturers being copied from our engines. I was in France the year before last, and saw some of these copies (I mean the engines themselves) in course of construction, and having made the original drawings myself I was familiar with all the details. These facts relating to a branch of English art, of growing importance everywhere, I deem not altogether unworthy of public attention."

Extraordinary Pieces of Plate Glass.—There is now to be seen at the Union Glass Works, St. Helen's, what is termed a perfect piece of plate glass, of the following unusual dimensions:—13 ft. 2 in. long, and 6 ft. 6 in. wide, and containing eighty-five superficial feet of glass.—At Mr. Saunders's shop in Regent-street, London, a square of glass may be seen, containing upwards of ninety-five square feet—the dimensions being 12 ft. 9 in. by 7 ft. 7 in.

The Wonder.—The South-Western Company's steam-boat with engines on the atmospheric principle, returned from her trial trip to Plymouth up Channel on Tuesday, and after taking a peep into Cowes, shot up the Southampton water with the speed of the lapwing. She travels without effort at the rate of sixteen miles and upwards per hour, while her engines do not occupy more than *a fourth* of the space usually required by other vessels, in proportion to size.—*Hampshire Advertiser.*

Progress of Steam Navigation in Russia.—On the Baltic there are 17 Russian steamers; on the Black Sea 18, including 5 for the service of the ports; 4 on the Caspian Sea; one on Lake Baikal in Siberia. There are also steamers on the Dnieper, the Dwina, the Wolshow, the Lake of Peipus and the Kama.

American Scraps.—The last new steam boat at New Orleans is called the *Lowndes.* She was built at New Albany: length 171 feet, beam 28 feet, and depth of hold 6 feet. She has two boilers and two engines, a cylinder of 17 inches, has 8 feet stroke, and will carry 1500 bales of cotton. Her draught of water is 30 inches; the cabin is fitted with 34 state rooms. She is intended for the Alabama trade.——A Mammoth steamer is building in New York, to ply on the Hudson. She is to be 340 feet long, with 40 feet beam. She is to have a 72-inch cylinder, and everything to correspond.——A locomotive engine on the Reading railroad lately brought a train from Pottsville to Richmond which weighed 904 tons.——Among many sources of wealth in Ohio, none makes more rapid progress than the manufacture of silk. The climate is highly favourable for the culture of the mulberry, and the rearing of the worms. The farmers at Mount Pleasant, Jefferson county, turned their land into mulberry groves a few years ago, and are now producing immense quantities of raw silk, which pays them far larger profits than farming. Mr. Gill has established a factory at Mount Pleasant, where he makes beautiful silk velvet, vest patterns, cravats, dresses, pocket handkerchiefs, &c. &c., all from native silk produced in Ohio!

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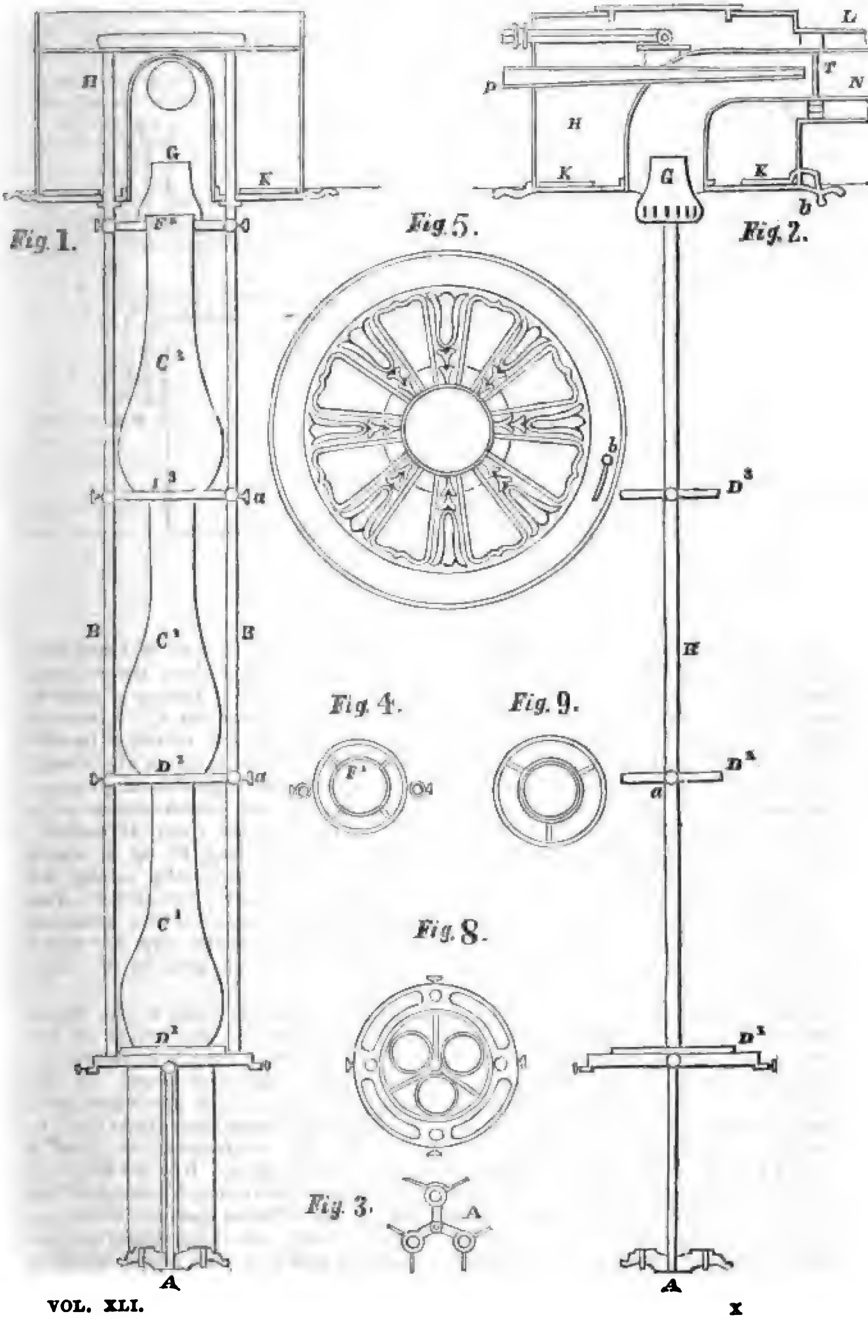
Edited by J. C. Robertson, No. 166, Fleet-street.

JONES'S REGISTERED PENDANT GAS LAMP.



JONES'S REGISTERED PENDANT GAS LAMP.

[Registered under the Act for the protection of Articles of Utility. James Jones, of Bow-street, Gas Engineer, Proprietor.]

Fig. 6.

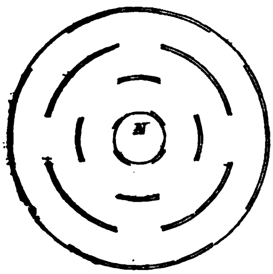


Fig. 7.

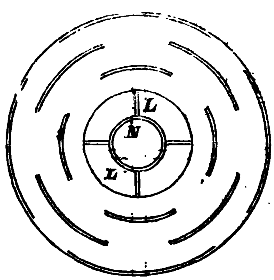
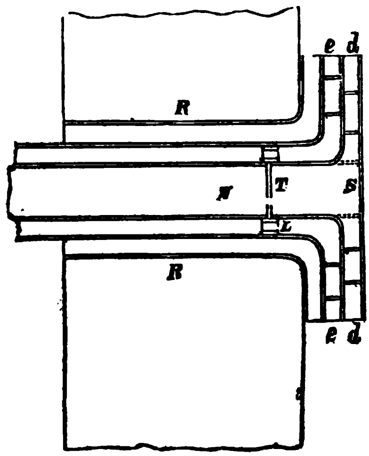


Fig. 2a.



We have not met with any household gas lamp which combines, in equal perfection with the present, the two great requisites in such articles—a steady and abundant supply of atmospheric air to the flame, and a sure and ready means of escape for the deleterious products of combustion. We intend to make use of it ourselves, and earnestly recommend it to the notice of all who are fond of a well-lighted and well-aired apartment.

Fig. 1 is a front elevation, and fig. 2 a side elevation of this lamp and its appendages.

A is a compound burner consisting of three burners on the Argand principle, arranged in one plane, so as to produce one strong column of light, as shown in the separate plan of this part of the apparatus given in fig. 3. B B are two tubes, which conduct the gas from the supply-pipe downwards to the jets of the burner.

C^1 C^2 C^3 are three bulb-shaped glass chimneys rising one above the other, and resting just below their greatest diameters, on rings D^1 D^2 D^3, which are connected to the supply pipe, E E, which are pendant from the roof, and common to all three. A plan of the lowest ring, D^1, is given in fig. 8. The top of each of the two lower chimneys, C^1 C^2, rises a little way within the chimney immediately above it; the height to which each is so raised being adjustable at pleasure by means of the thumb-screws *a a*. Within each of the rings, D^2 and D^3, there is an inner ring, F^1, fig. 4, which encircles and serves to keep steady the tops of the chimneys, C^1 and C^2. The top of the chimney C^3 is also encircled and steadied by a similar ring, F^2, which is attached by radial arms to the funnel G.

H is a ventilating head, or cap, which is inserted between the ceiling of the room in which the lamp is hung and the floor of the apartment above. It has openings on the under side which correspond with similar openings in the fly-plate K. The ornamental face plate is represented in fig. 5. K is the fly-plate, by turning which round, by means of the knob *b*, the different apertures are opened or closed, and either wholly or partially, at pleasure. L is a pipe, which is

carried from the head H in a lateral direction through the wall M, to the external atmosphere.

The metal funnel, G, opens into a pipe N, which, passing up the centre of the head H, turns off at a right angle, and terminates in the windguard, (fig. 2*a*) on the outside of the building.

While the more immediate products of combustion pass away through the chimneys C, funnel G, and pipe N, the heated and vitiated air of the apartment escapes through the openings in the ventilating head H, along the pipe L, to the windguard S.

P is a small conical draught-pipe, which is carried from the outside of the building through the ventilating head H, into the funnel-pipe N, terminating just beyond the right-angular bend of the latter. The cold air rushing through this pipe serves to impart a great increase of velocity to the column of heated air and vapours escaping through the tube.

R is an opening for the escape into the atmosphere of any heated air which may accumulate between the ceiling and floor.

T is a ring by which both the outer and inner pipes are joined; an edge view of it is given in fig. 9.

S (fig. 2*a*) is an external cover or windguard, affixed to the mouth of the pipe L, by which any back draught is prevented. A section of this windguard on the line *d d*, is given separately in fig. 5, and a section of it on the line *e e*, in fig. 7.

LIPSCOMBE'S SUBSTITUTE FOR THE CRANK.

Sir,—Your correspondent "S. M." maintains that the crank of an engine is a perfect circular transmitter of power, and yet, strangely enough, in his last letter in No. 1107 of your Magazine, he says "the effect produced ought to be, that the weight, after falling through half a circle should ascend only one half the height from which it fell." It is amusing to note the way by which your correspondent arrives at this conclusion; however, this assertion would lead a good mechanician to suppose that "S. M." means that half of the gravitating force of the weight, in descending through half a circle, would be expended some other way than in turning the wheel, because a well-known mechanical law would lead us to expect that the impetus which the weight would receive after falling through one half circle would carry it through the other half circle, provided there were no resistance and no friction, and provided the whole gravitating force of the weight were exerted in turning the wheel during the first half of its revolution. We are well aware the mere friction of the wheel upon its axis would offer but a trifling resistance to the motion of the wheel.

Your correspondent says, "that no engineer ever thinks of applying the power of an engine to the crank in the position in which it is represented in fig. 1, No. 1101 of your Magazine;" to this I have to say, that that experiment was merely to show that whatever force might be exerted against a crank, while in the line of centre, has not the slightest tendency to turn the crank, but that the whole force of the weight is being exerted in the direction of the crank centre. Does "S. M." really suppose that the mere shifting of the crank a little, either to the right or left of the line of centre, would enable it to transmit all the force exerted against it in a circular direction, and none whatever in the direction of the crank centre? It will readily be seen, that while the crank is travelling from the line of centre, to half stroke, the pressure transmitted by the crank towards its centre is gradually decreasing, while that transmitted in the direction of its circle is as gradually increasing, and *vice versa*, from thence downward again to the line of centres. Nothing really can be plainer than this; it is evident there is precisely the same amount of pressure transmitted in the direction of the crank centre, as in the direction of the crank circle during each stroke; and we are well aware, that whatever force is transmitted by the crank in the direction of its centre cannot be made available by us, consequently, that force must be wasted.

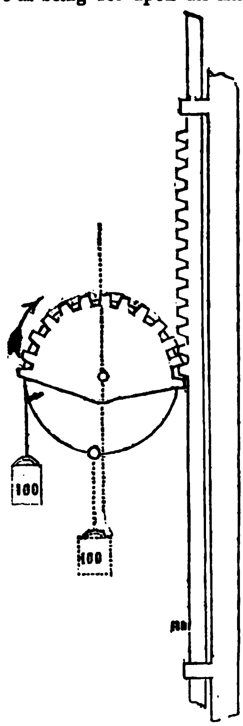
If a long heavy crank be placed upon an axis, and the hand employed in turning the crank upwards, it will be found that the nearer the crank is raised to a horizontal position, the heavier the crank will appear to be, and the greater strength will be required to lift it, and after passing the horizontal position, the nearer it arrives to the upper line of centres, the easier it will be to raise it. Let me recommend "S. M." and all other crank advocates, not to consider the crank as a perfect circular transmitter of power, until they can account for this variable resistance which the crank offers to the hand, because such an investigation will give them a great deal of insight into the defects of the crank.

Your correspondent says, "with respect to figs. 2 and 3, in No. 1101 of the *Mechanics' Magazine*, these do not fairly represent the relationship which subsists between the power of an engine and the resistance to be overcome thereby." The objection "S. M." has to those experiments, I presume is,

that there is at the time no motion. The crank can be more accurately tested when unconnected with a connecting rod than otherwise, and more accurately when at rest than in motion: because we are enabled to tell exactly the amount transmitted by it in a circular direction, and the amount given out in a central direction at every point of its orbit. Your readers will readily see that the weights hung upon the crank pins would (were the cranks in those figures put in motion) travel through the same space (as they describe a semicircle), and at precisely the same velocity as the weights hung upon the wheels; and yet it will be seen that a 50 lb. weight hung upon the wheel, in fig. 3, will balance a 100 lb. weight hung upon the crank. The 100 lb. weight acts upon the crank pin in precisely the same way, as if an infinitely long connecting rod were attached to the crank pin, and a steam pressure of 100 lbs. was being exerted in pulling down the connecting rod; with this difference only, that the gravity of the crank weights acts equally through every portion of the semicircular space, so that, of course, each would exert one-third greater pressure against its crank than a piston rod would do, because a piston rod only passes through a space equal to the diameter of the crank circle.

"S. M." gives us a pretty specimen of his mechanical knowledge by stating that, although a weight describes a semicircle in descending from the top to the bottom of a wheel when attached to it, yet the gravity of the weight will only be acting through a space equal to the diameter of that circle, of which it describes the half. He is quite incorrect. The space through which the gravity of a body acts is not as the perpendicular height of its descent, *but as the space passed through*; because the gravity of the weight is always acting, however much it is forced to vary from its line of direction. To say that it is as the perpendicular height of its descent is a very gross absurdity; but, although I say the gravity of the weight acts equally while descending through a semicircular space, say of 15 feet, as in descending perpendicularly through a space of 15 feet, I do not say that it would accumulate as much impetus when it arrives at the bottom, as if a similar weight fell perpendicularly through a height of 15 feet, because the accumulated force in the former case (without including friction) would only be precisely half that of the latter. To make this easily understood, we must recollect that a weight resting upon a perfect plane gives out the whole of its gravitating force perpendicularly downward, and none whatever horizontally; now, when a weight is forced through a quarter of a circle, the average direction of its movement is exactly midway between a horizontal direction and a perpendicular direction; therefore it is thoroughly impossible that more than half the gravitating force of the weight can be given out, upon an average, in a circular direction; hence, a 10 lb. weight falling through a *semicircular* space of 15 feet would, upon arriving at the bottom, receive an impetus only equal to a 5 lb. weight falling through a *perpendicular* space of 15 feet.

The following experiment will prove this reasoning to be correct. The segment of a toothed wheel is represented in the following figure as being set upon an axis; fixed



to the segment is a wheel of the same diameter as that of the pitch circle of the toothed segment; a weight of 100 lbs. is hung upon the wheel, as shown; and a rack weighing 100 lbs., made to rest upon the segment teeth. The effect is that the rack and weight balance each other, consequently, no movement is produced. Now, by taking off the weight from the wheel, and rehanging it upon a projecting pin, a little aside of the line of centres, the weight of the 100 lb. rack will turn the wheel in the direction of the arrow, rapidly carrying the weight up-

wards to the line of centres (the rack then drops out of gear with the toothed segment), and flings it past the centre line. The weight then, with the impetus given to it, and its own gravity, descends and rises a second time to a considerable height. It will be seen from this experiment that the rack has not anything like a resistance equal to 100 lbs. to overcome, although it raises easily and rapidly a weight of 100 lbs. with the same speed as the rack itself descends.

Your correspondent in closing his letter says, "I must conclude without entering, as I had intended, into an investigation of the power transmitted by a crank compared to the pressure of steam in the cylinder of an engine, by which I should have clearly shown that no power is lost by the use of the crank." "S. M." is evidently trying to get out of a difficulty by mere assertion; had I been in his place I should as speedily, and as clearly as possible, have attempted to prove by a series of experiments, that no power was wasted by the crank: your correspondent knows very well that he cannot demonstrate by a single experiment, that the crank wastes no power. I have no doubt, your correspondent intended, like other crank advocates who write upon this subject, to have given us tables, such as appear in Russell's work upon the steam engine. One of these shows the velocity of the crank as compared with its piston during a stroke; but this table only proves that the crank travels over about one-third greater space than the piston during a stroke. The other table pretends to show the per centage of pressure given out by the crank in a circular direction at several points of the crank's orbit, as compared with the pressure of the steam upon its piston; now this latter table is a most erroneous one, and is especially calculated to mislead those who are only superficially acquainted with mechanics, and it is greatly to be deplored, that Mr. Russell, before introducing such a very erroneous table in his excellent work upon the steam engine, did not try a series of experiments with a view of testing the merits of the crank. Let "S. M." show by actual experiments, and not attempt by mere theorising to prove that it is the all-powerful instrument alleged.

In conclusion, permit me to inform you, that Mr. Lipscombe intends publishing descriptions of his patented inventions; he has specially entered minutely into the subject of the crank; the descriptions are illustrated by suitable engravings; and any of your readers sending to 93, Regent-street, after the 10th of November, will receive a copy *gratis*, or one will be forwarded on application by enclosing two penny stamps to pay for the postage.

Thanking you for your very great kindness in giving insertion to my communications in your excellent Magazine,

I am, Sir, your obedient servant, N.

When I penned the preceding communication, I was not aware that I had another crank advocate to contend with. As my answer to "S. M." will likewise, with a little addition, serve for "W. J.," I hope the Editor will be so kind as to afford me an opportunity of adding a few remarks.

A great portion of "W. J.'s" letter is occupied in harping upon what he considers the inappropriateness of the term *misdirected*, when applied to the pressure given out in the direction of the crank centre, in fig. 1, No. 1101 of your Magazine. The term is correct. I wished to know what amount of average force in a *circular* direction was given out by a 100 lb. weight hung upon a crank, during *a quarter of a circle*. When the crank was in the line of centres, I found that no force was given out by the weight *in a circular direction*, but that the whole gravitating force of the weight was misdirected towards the crank centre. Your readers will immediately see that fig. 1 represents the crank *at one extreme point* of that half circle, and in fig. 2, at the other extreme point; they will see that my term was perfectly correct, as the amount of force given out by the weight *in a circular direction only*, was then being discussed. The remainder of my explanation will be found in my letter to "S. M."

"W. J." would seem to be not a sufficiently good mechanician to know that the positions of the weight in his diagram are very different to those in the fig. 3, to which he alludes. His 100 lb. weight would only pass through half the space of his 50 lb. weight during an instant of time, whereas the weights in fig. 3 would pass through an equal space during an instant of time. I have thus pointed out a very great blunder upon the part of your correspondent. He asks me if I would say that 50 lbs. out of his 100 lb. weight was misdirected? To this I answer—Decidedly not; no misdirection of the gravitating force of a weight ever takes place when the arm to which the weight is attached is in a horizontal position; the amount of misdirection depends entirely upon the degree of obliquity in the position of the arm. Now he will observe this difference in the position of the short arm of his lever, and that of the crank in the above-mentioned fig. 3; his lever is in a horizontal position, but the crank is at an angle of 45°. Although the effect produced is the same in both cases—that is, a 50 lb. weight is made to balance a 100 lb. weight—this result is

produced in his case by the difference in leverage of the two arms; but, correctly speaking, the results produced in fig. 3 are not owing to any difference as respects leverage, as none exists; but to the fact that the direction of the crank is then exactly midway between a perpendicular and a horizontal direction; and therefore the force which is then being exerted upon the crank pin will be given out downwards from the crank pin at an angle of 45°, in two divisions, one running down, as it were, to the crank centre, the other being transmitted at the same angle in an opposite direction, as shown in that fig.; and the only amount of force then tending to turn the crank will be that given out in the latter direction. The remaining force is, of course, misdirected, because it takes a direction contrary to our desire.

"W. J." recommends me to try certain experiments. Permit me to suggest to him not to recommend the performance of any experiments until *he* has first tried them: crank advocates are not overburdened with mechanical knowledge, and "W. J." would find himself in the same predicament as "S. M.," inasmuch as the results of those experiments would prove a waste of power to exist, although, from the difference in the size of his wheels, less waste would be shown by them than if the crank were used. To show the actual waste of power the wheels should be of the same size, as the weights would travel at an equal velocity.

From the blunder in "W. J.'s" letter, I am not at all surprised that he does not consider any waste of power to ensue by the use of a connecting-rod. With your permission, after the crank has been fully discussed, I will enlighten him and "S. M." upon that subject.

Respecting the relative merits of crank substitutes, your readers will see that he does not possess sufficient mechanical knowledge to be a judge; that subject will likewise be entered into with your permission, when the crank and its connecting-rod have been fully investigated.

The only point where the most scientific crank advocates err, is in supposing that the gravitating influence of the 100 lbs. weight hung upon the crank in fig. 3, is only equal while describing a semicircle to a 100 lbs. weight falling through the diameter of the crank circle. Let us imagine such a supposition to be correct: the perpendicular space the crank in that fig. would pass through, were it in motion at that instant, would be as about 3 to 2, compared with the perpendicular space then passed through by the weight hung upon the wheel; therefore, the force then being actually transmitted by the crank, would be about 63 lbs. But we find by experiment, the force then transmitted in a circular direction is only 50 lbs.: it will be seen, that this result will not bear out their supposition; therefore, their supposition is quite incorrect. Now, I contend that the gravitating influence of the weight acts according to the *space gone through*, and not merely as its perpendicular descent. And the reason that the 50 lbs. weight balances the weight of 100 lbs. is, because the crank, if set in motion, would at that instant be moving in a direction midway between a perpendicular and a horizontal direction; therefore, the force of the weight would be equally directed from the crank pin towards the crank centre, as tending to turn the crank. I further contend that the position of the crank in that fig. will show the average force transmitted by the crank in a circular direction, were that crank made to perform a stroke, and that therefore, upon an average half, the gravitating force of the weight throughout a stroke is waste.

N.

COST OF RAISING WATER TO GIVEN ALTITUDES.

[From the Minutes of Evidence taken before the Commissioners of Enquiry into the State of Large Towns and Populous Districts.]

Thomas Wickstead, Esq., C.E., examined.—At the request of the Commissioners I have prepared the following statements of the cost of raising water:—

1st. A single pumping engine, made by Boulton and Watt, in 1800, working $10\frac{1}{4}$ hours per diem, 6 days per week, mean power $29\frac{1}{2}$ horses; quantity of water raised per diem equal to 612,360 gallons, 100 feet high; the cost of coals 12*s.* per ton. In the estimate for the cost all charges for coals, labour, and stores, are included, but no charge for interest upon outlay, or repairs of machinery and buildings; all other charges for working the engine are included.

	s.	*d.*
Cost of raising 1000 gallons 100 feet high..................	0	0·543
Or, cost of raising 22,099 gallons 100 feet high	1	0

This estimate is made upon an average of two years' working.

2nd. Two single-pumping engines, made by Boulton and Watt in 1809, working 24 hours per diem, 7 days per week, mean power of each engine $30\frac{1}{4}$ horses; quantity of water raised per diem, 2,922,480 gallons, 90 feet high; the cost of coals 12*s.* per ton. Labour, stores, &c., taken as in the first case. The estimate made upon an average of 10 years' working.

	s.	d.
Cost of raising 1000 gallons 100 feet high	0	0·358
Or, cost of raising 33,519 gallons 100 feet high	1	0

3rd. Two single-pumping engines, made by Boulton and Watt, one in 1816 and one in 1828, working 12 hours per diem, 7 days per week, mean power of each engine 76 horses; quantity of water raised per diem 3,601,116 gallons, 100 feet high; cost of coals 12*s.* per ton. Labour, stores, &c., as before. The estimate made upon an average of 10 years' working.

	s.	d.
Cost of raising 1000 gallons 100 feet high	0	0·333
Or, cost of raising 36,036 gallons 100 feet high	1	0

4th. One single-pumping engine, made by Harvey and Co., upon the expansive principle, in 1837, working 24 hours per diem, 7 days per week, mean power 95½ horses; quantity of water raised per diem 4,107,816 gallons, 110 feet high; cost of coals 12*s.* per ton. Labour and stores as before. The estimate made upon an average of 4 years' working.

	s.	d.
Cost of raising 1000 gallons 100 feet high	0	0·150
Or, cost of raising 80,000 gallons 100 feet high	1	0

The foregoing statements of the cost of raising water with different engines will show that there is a great variation. The comparison, however, is favourable to the engines upon the old plan, as those quoted are good ones. The following table will show the variation more clearly:—

To raise 160,000,000 of gallons of water 100 feet high, it would cost,

According to the 1st statement		£362
ditto	2nd ditto	238
ditto	3rd ditto	222
ditto	4th ditto	100

John Farey, Esq., C.E., examined.—Taylor's engine, at United Mines, which has made the highest performance of any yet constructed, has on an average of all the variations of its performance, during the 12 months of the year 1841 raised 92¼ millions pounds weight of water, 1 foot high, by each bushel of coal which has been consumed by it; and in 1842 the average was 99¼ millions.

An average of the two years would be 95¾ millions. A bushel of the coal actually used is considered on an average to weigh 94 pounds, and if Taylor's engine be reckoned to raise only 94 millions pounds 1 foot high, by the consumption of each bushel of 94 pounds, then one pound of coal will raise one million pounds of water 1 foot high.

As a million pounds is not a very conceivable quantity, it may be considered as 16,000 cubic feet of water (which reckoning each cubic foot to weigh 62½ pounds, would be a million pounds weight) raised 1 foot high. Or if the height be reckoned at 10 feet, instead of 1 foot, then it would be 1,600 cubic feet of water raised 10 feet high, by the combustion of one pound of coal.

To render this more clear, suppose an apartment 20 feet square on the floor, between the walls, to be filled 4 feet deep with water, like a large bath, it would contain the 1,600 cubic feet of water. And supposing another upper apartment of the same size over the former, the height from the lower floor to the upper floor being 10 feet, then with the consumption of one pound of coal, Taylor's engine would exert a sufficient power to raise all the water from the lower apartment into the upper one, in addition to overcoming the friction of all the moving parts of the engine and of its pump work.

A robust labouring man, possessing such strength and capability of enduring exertion, as is an average of that class of men in Britain, would be incessantly employed during four hours, 26¾ minutes in performing the above work. Such a man could work at that rate during ten hours in a day, and six days in a week. Taylor's engine would perform the day's work of the man with a consumption of only 2¼ pounds of coal.

A good draught horse would be 45¾ minutes in performing the above work, and could continue to work at that rate during eight hours in a day, for six days in a week. Taylor's engine would perform the day's work of the horse with the consumption of 10½ pounds of coal.

What is called a horse power in steam engines, is fixed by Mr. Watt, viz. 33,000 pounds force acting through a space of 1 foot per minute, is half as much more as the average of what a good draught horse can do, so as to continue working during eight hours per day, and for six days per week.

Taylor's engine, (or any other,) when raising 94 millions per bushel, consumes only 1·98 pounds of coal per hour for each horse power which is exerted by it in raising the water, independently of overcoming its own friction, and that of the pumps. Or when it exerts 100 horse it consumes only 198 pounds of coal per hour.

Taylor's engine exerted 102½ horse power on an average of all the variations of the power which it exerted in the year 1841, and 127¾ horse power in 1842. On an average of both years it would be 115 horse power, and which, according to the above statement of 1·98 pounds of coal, would be attended by a consumption of 227¾ pounds of coal per a ur, that being on an assumption that the verage performance during the two years was 94 millions, when in fact it was 95¾ millinos

INFRINGEMENT OF REGISTERED DESIGN.

Guildhall, City of London, Nov. 5.

[Before Aldermen Sir George Carroll and John Johnson.]

(From the *Times.*)

Messrs. Warner and Sons, brass-founders, attended to answer an information which charged that the defendants had sold a boiler tap, to which the registered design, No. 190, of Thomas Wolferstan, of Salisbury, for a safety-boiler tap, had been applied without his consent.

Mr. Webster attended to support the complaint, and Mr. Clarkson defended Messrs. Warner.

The certificate of registration was put in.

Samuel Milne, in the service of Messrs. Robertson, of Fleet-street, patent agents, proved the purchase of a boiler tap at Messrs. Warner's for 1*l.* 2*s.* 9*d.* He produced it, as also a sectional drawing of it, and of the registered design. In principle, he said, they were alike. The plug in both was alike, and the other parts of the imitation were so near to the original as to answer the same purpose. He had made the drawing twice the size of the article for facility of comparison.

Mr. Clarkson objected that no case had been made out. The drawing of the Wolferstan design could not be taken as evidence. The article itself should be produced, that the magistrates might compare them, and that it might be seen that Wolferstan had entitled himself to the benefit of the act by manufacturing them for use, and not publishing them without the mark of registration.

Mr. Webster said, the magistrates had before them the registered description and drawing, and that was the standard by which the imitation was to be tried. He was entitled to the protection of the registration if he did not manufacture a single article during the three years.

Sir G. Carroll confessed he should have been better able to judge if the articles themselves had been placed before him for comparison.

Mr. Alderman Johnson expressed a similar opinion.

Mr. Webster said he could not be called upon to prove a negative. It was not for him to show that no safety-boiler tap had been issued without the registration mark, by calling everybody to whom one had been sold, nor was he to produce in court a steam engine or anything else that might be registered. The registered description was all the law required.

Mr. Milne said, he made the drawing of Wolferstan's invention from Mr. Wolferstan's description, and not from one of the articles. He had since had one of the Wolferstan taps in his hand, and found it answered to his drawing. This was two days ago.

Mr. Clarkson urged that it was very suspicious that Mr. Wolferstan did not produce one of his taps, that the magistrates might see whether Warner's was an imitation. The drawing they had of it was not even made from the article itself, but from Wolferstan's description.

The magistrates seemed to be about to decide against the complaint, when

Mr. Robertson said, he had a Wolferstan cock, which the magistrates might compare with the imitation purchased by Mr. Milne. He proceeded to exhibit them, and compared the various parts to show, in the principle of the article, they were alike: and the variation in shape did not prevent them from answering the same purpose.

Mr. Clarkson begged the magistrates to remark that the registered tap was carefully kept back till it was wrung from them by the apprehension of an adverse decision, and he proceeded to show that the article produced as Wolferstan's was unlike, in some portions, the registered design. He insisted that the act did not include inventions of this class, and that Mr. Wolferstan, by endeavouring to evade the expense of taking out a patent at an expense of as many pounds as he had paid shillings for the registration, had overreached himself. The part for which registration was obtained was a mechanical contrivance, and not a mere change of form or configuration, to which alone the act applied.

The Magistrates conferred for some time; and then

Sir G. Carroll said, they did not think the case was proved.

Mr. Webster asked in what respect?

Sir G. Carroll declined going further into the question.

Whether it would have added any weight to the above decision, had the enlightened justices who pronounced it condescended to give their excellent (or exquisite) reasons for it, we will not presume to say; but we must take leave to remark that the course pursued in declining to state "in what respect" the plaintiff had failed to prove his case, was not only wholly unusual, but one calculated to be productive of consider-

able public harm. For anything that appears in the report of the *Times*—and it is on the whole a correct account of what passed on the occasion—the plaintiff did make out a case of gross and palpable infringement against the defendants, and one, too, turning wholly on "shape and configuration,"—did "prove" everything, requisite to entitle him to the redress provided by the statute; and the reader is therefore left to infer that the real cause of the plaintiff's being nonsuited, must have been something quite beside the facts of the case—some huge technical defect, perhaps, in the Act of Parliament, detected by these astute justices, which disabled them from carrying out the intentions of the legislature, and which, out of a rare tenderness for the authors of the Act, they chose to keep to themselves, or, it may be, some difference of opinion between the Wisdom of Guildhall Yard and the Collective Wisdom of Westminster, as to the policy of fostering inventive genius, and discouraging piracy. Whatever the real cause was, it should have been openly and distinctly avowed. The office of the magistrate is not only to administer, but to expound the laws. The manufacturers and mechanics of the metropolis—all, indeed, who are in any way interested in new inventions and improvements (and who is not?)—are deeply concerned to know what extent of protection is afforded by the statute in question, and how far dependance may be placed on the disposition or ability of our Justices to exercise the powers with which it invests them. When a man is nonsuited in any of the superior courts, he is never left at a loss for the reason why; and though "Justices' Justice" has at no time stood very high in the world's regard, it could never, at least, be said of it, that its delight was in the silent mood. The besetting sin of our Great Unpaid has been that they have been prone to talk overmuch. Here we see a sample of a vice of another sort. A pair of worshipful dummies, who shake their heads, but are either unwilling or unable to render a reason. If they had but stated some grounds for their decision, we should have known whether the fault was in them, or in the law they were called on to administer, and seen the way, perhaps, to a remedy for the future; but as it is, we are left to guess, whether the defeat of the plaintiff was owing to the question at issue being one beyond the comprehension of men of the class of our city magistrates, or to some defect or blunder in the law itself.

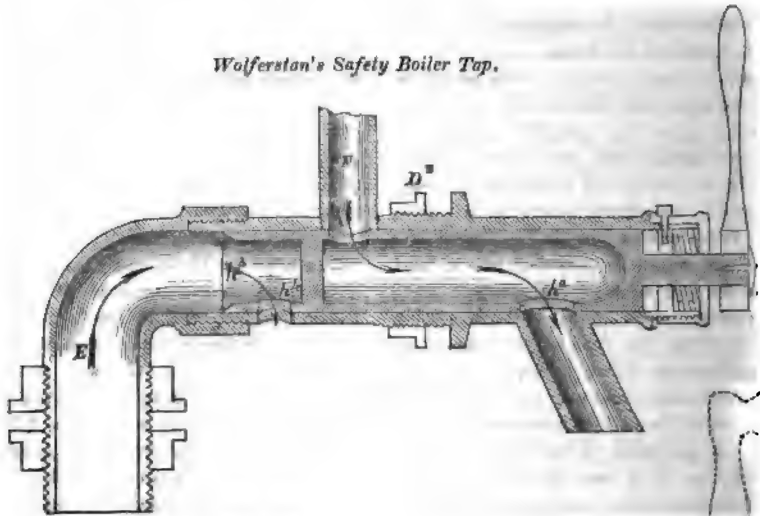
A failure of justice through the ordinary tribunals has not unfrequently been repaired by an appeal to that highest of all tribunals Public Opinion; and in the hope that it may be so on the present occasion, we annex exact copies of the sectional drawings which were produced by the witness, Mr. Milne, and sworn by him to be faithful representations of the two taps in question, the genuine article and the counterfeit. The merits of Mr. Wolferstan's invention have been already treated of in our pages (see *Mechanics' Magazine*, vol. xli., p. 23); but to save the trouble of reference, we give here also so much of the description contained in the certificate of registration as is necessary for the purpose of explanation. We can be in no doubt as to what the unanimous judgment of the mechanical world will be on an inspection of those drawings. Never were there two things more alike; never a case of unlicensed appropriation more barefaced and indisputable.

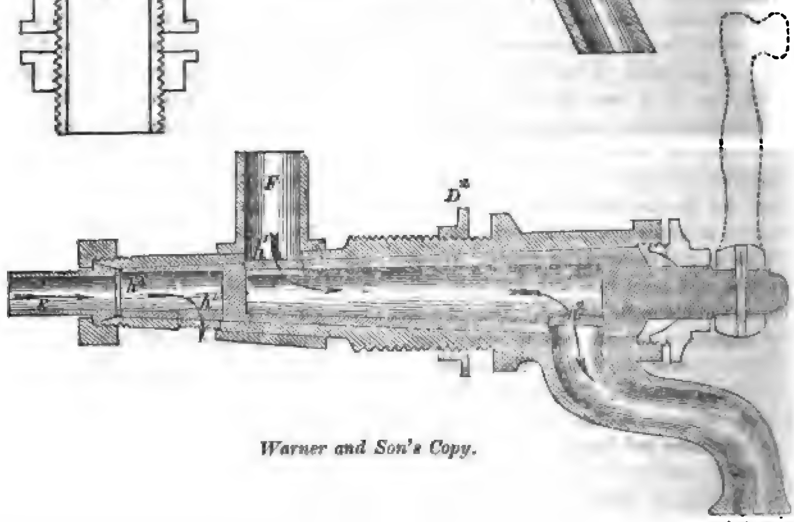
Description.

(For Engravings, see next page.)

F is a pipe which rises vertically from the part of the barrel immediately behind the front plate of the boiler, to the surface of the hot water. G is a pipe for the outflow of the hot water from the tap. H is the plug; h^1, water way in the plug, which being opened to the vertical pipe F, admits the hot water; h^2, the water way for the escape of the hot water; h^3, a circular recess in the end of the plug, which is open to the cold water supply pipe E; and h^4, a water way cut into the recess h^3. The three water ways, h^1 h^2 h^3, are so arranged, in point of position with respect to one another, that when any one of them is opened by the turning of the plug, by means of the handle N, all the three shall be opened. The result is, that as often as hot water is drawn off from the boiler, an equal quantity of cold water is admitted to it, and that at a point

Wolferstan's Safety Boiler Tap.





Warner and Son's Copy.

where it can have little, if any, effect on the temperature of the water at the surface. The boiler is thus always kept more or less filled, and all danger of destruction and injury to it, from the metal being left uncovered with water, is prevented.

THE BRITISH ASSOCIATION—YORK MEETING, 1844.

[Selected from the Reports of their Proceedings in the *Athenæum* and other Journals.]

[Continued from page 304.]

Tide Observations on the Coast of Ireland.—Datum Plane.

The ASTRONOMER ROYAL introduced this subject by stating, that during the Ordnance survey, it had been desired to fix upon a datum plane, and that at first it was intended to assume the level of low water at spring tides as that datum. But the researches of Dr. Whewell having shown that level not to be invariable, Colonel Colby became desirous of ascertaining whether one invariable and certain datum plane could be obtained. For the determination of this, Ireland seemed to present peculiar facilities; for, during the Ordnance survey, it had been levelled from shore to shore, not only longitudinally, but also across, in lines as nearly parallel as could be accomplished; the result of which was, that round the entire coast many points were marked where the relative level to one common point, the sill of one of the dock gates in Dublin, were known certainly to within a very few inches. It was, therefore, resolved to observe, simultaneously, and for a considerable period, the tides round the

entire coast, in order to ascertain whether, from their phenomena, such a certain and readily determinable datum plane could be deduced. In these observations, besides having all the measures of height reduced to this one common standard, it was also determined that all the observers should be furnished with chronometers set to one common time, viz., mean time at the Greenwich Observatory. The first peculiarity observable was, that while the south-western and western coast was quite open and exposed to the Atlantic, the north-eastern and eastern coasts were, on the contrary, quite embayed; and in particular as the channel became very narrow between Donaghadee and Portpatrick, and indeed the entire Scotch coast to the Mull of Kintyre, they were prepared for, and found, much irregularity and confusion of the tides on the north-east coast. He need not then particularize all the motives which swayed them, but state generally that twenty-two stations round the coast were fixed upon. On the 22nd of June, 1842, they had all their observers at the several stations, and the observations were continued day and night for full two months, viz., until the 26th of August. The researches of Professor Whewell and of Sir John Lubbock had rendered a close attention to the diurnal and semi-diurnal inequalities of the tides a matter of interest. One of the earliest and most immediate results of these systematized observations was, that the high tide was found to be simultaneous along the entire western and south-western coasts. It was also simultaneous along the eastern coast, but, strange to say, with a jump of no less than six hours between these two clearly defined times of high water: so that they were met in the first stage of their speculations by the fact, that there was a difference of no less than six hours between the time of high water at Skibbereen and at Dublin. This was, for a time, a puzzle; but from it might be inferred, what they afterwards found verified by the observations at Courtown, that a node, or place of no tide, must occur at some intervening place. The observations have been grouped and discussed by the new mode pointed out by him in the Philosophical Transactions for 1842, in which the heights were expressed as a function of the times, by the following formula:

$$L = A + B.\ \sin.\ \theta + C.\ \sin.\ (2\,\theta + c) + D.\ \sin.\ (3\,\theta + d) + \ \&c.$$

By this method, about 1,400 individual tides, observed at all the stations, had been discussed. From this discussion, it appeared that the great tide wave was two days old when it reached Ireland, and that the solar effect exerted in raising the water, was about one-third of that of the moon, if the deductions were made from the tides of the more open western and south-western parts of the coast; while the inferences deduced from those of the north-eastern coast, would make it only the one-sixth of the lunar influence. This difference doubtless arose from the irregularities observed in the tides of the north-eastern coast, for which they found a ready explanation in the enormous amount of the semidiurnal inequality which there manifested itself: the semi-menstrual inequality was also found to be considerable there. Another remarkable and unexpected irregularity also resulted from these discussions which was a difference of no less than 1 foot between the mean heights of the tides of the western and southern, and the north-eastern coasts; the mean heights of the tides, or values of A, in the preceding formula, being 1 foot greater for the north-eastern than for the south-western stations: and this fact afforded the most demonstrative proof of the accuracy of the observers, for while it manifested itself most distinctly at each of the stations in going round the coast, its amount and the law of its variations were so consistent, as to render it absolutely impossible that it could have resulted from careless observations. He then directed attention to the Courtown station, stating that at the commencement of their labours here the observers had found it impossible to comply with the instructions which had been furnished to them, for they found that they could not, by any diligence, anticipate the times of high or low water by half an hour, or even an hour. The result was, that of themselves they adopted the prudent course of giving up any attempt at such anticipation, and observed the height of the tide every five minutes throughout the 24 hours. This was a fortunate circumstance, for in consequence of being in possession of these, almost continuous observations for such a period, he had been able to make out the law; which, under other circumstances, might have long continued to perplex. It was found that tides very small in their actual amount, sometimes not more than a few inches, but very numerous, were continually succeeding each other at irregular intervals: and this was very clearly traced to the influence of the relative large amount of the solar tide; which modified what might be considered the true tide of the place, very differently according as it arrived at the place an hour or two before, or an hour or two after, the coming of the sun to the meridian. The Astronomer Royal said that he was preparing a detailed account of these observations; and he closed by saying, that in reference to the object for which they had been chiefly undertaken, it was now obvious that no fixed plane sufficiently deter-

minate for engineering purposes, could be deduced from the phenomena of the tides; at least those observed on the coast of our island or continental seas.

The Gold Ores of Merionethshire

A communication on this subject was read from Mr. A. DEAN, C.E.—The author states that the Cwmheisian Mines, near Dolgelly, which have yielded as much as seven ounces of fine gold per ton of ore, form part of a regular system of auriferous veins which occur throughout the whole of Snowdonia, in a group of strata, remarkable for the repeated alternations of igneous and sedimentary deposits, which are occasionally traversed by dykes or elvans, and mineral veins. The first series of mineral veins are quartzose, and contain ores of argentiferous galena, copper, blende, &c.; their prevailing direction is S.E. and N.W., and they usually dip to the N. The second series always intersect the first, and are generally filled with carbonates of lime and barytes, with galena and blende ores; their general bearing is N.E. and S.W., with a dip to the N. The veins of the third or auriferous series, traverse both the other sets; they are usually but from ⅛th of an inch to 6 inches wide, but sometimes as much as two or three yards; they are occasionally filled with indurated clay, at other times with oxides of iron, iron pyrites, decomposed blende, &c. The gold is found chiefly where these veins intersect those of the first series; it forms a coating on the spar, and also occurs as interlacing fibres. The veins traversed by the gold veins are also enriched by them on the south side of the intersection, but never on the north side, and this only takes place at all where the dip is to the north. The gold veins are very numerous, occurring singly, or in considerable numbers, within a few feet of each other; if a lead ore is productive at its intersection with the gold veins, as at the E. Cwmheisian mines, it sometimes produces two to twenty ounces of gold per ton of washed ore; some ores yield twelve or fourteen ounces of gold per ton as broken. In this mine are ten quartzose argentiferous lead veins of the first series; these are crossed by numerous auriferous veins or joints, 1 inch to ⅛th in width; and as it would be impossible to work them by themselves, and the other veins are very productive of lead, the whole body of the lodes is broken down in a crushing mill, and the gold washed with the lead ore. At the Berthllwyd and other mines, the produce of the auriferous veins was found to be fifty-nine ounces five dwts. per ton of ore, and of silver sixteen ounces fifteen dwts. per ton. The average produce of the gold ore in Siberia, the Ural Mountains, and South America, seldom amounts to one ounce of fine gold per ton of ore, and even four dwts. is considered a workable quantity. The author considers that numerous gold veins exist in Merionethshire, and that a considerable amount of gold will be obtained when the character of the ore is better understood.

ON THE ELECTRICITY OF STEAM. BY G. A. ROWELL, ESQ.

The cause of rain, evaporation, and atmospheric electricity, having engaged my attention for many years, I endeavoured, in two papers read before the Ashmolean Society, 1839 and 1841, to show that evaporation is caused by the increase of the surface of particles of water by expansion, and that thus having a greater capacity for electricity, they are buoyed up by their coating of electricity as a bullet may be buoyed up in water by a coating of cork, and that *no evaporation at low temperatures could go on without electricity;* that the vapour so raised into the air, when condensed, becomes surcharged with electricity, and thus remains suspended until the surcharge escapes, either as lightning, or else imperceptibly, to the earth, when the remaining coating of electricity, being insufficient to buoy up the particles of vapour, they fall as rain, &c.; and that it is possible to cause rain at will by raising electrical conductors to the clouds, by means of balloons, and thus enabling the surcharge of electricity in the clouds to escape to the earth.

The discovery of the electricity of steam I considered a strong support of these opinions; but a theory having been proposed by Dr. Faraday, who explained the electricity of steam as caused by the friction of particles of water carried along by the steam rubbing against the solid matter of the passage through which the steam is escaping from the boiler,—the following is an attempt to show that the electricity of steam is not caused by friction, but by its expansion, on escaping from the boiler, thus carrying off electricity, and rendering the boiler (if insulated) negative, the steam again giving off its positive electricity when condensed; and that the phenomena of Dr. Faraday's experiments will support this hypothesis.

One experiment, which I believe tells against the theory of friction is as follows:—"An insulated wire was held in the stream of steam issuing from a glass or metal tube, about half an inch from the mouth of the tube, and was found to be unexcited; on moving it in one direction, *a little further off, it was rendered positive;* on moving it

in the other direction, *nearer to the tube, it was negative.*" In addition to this, both Mr. Armstrong and Mr. Pattison, in their experiments, found the greatest development of electricity at some distance from the boiler, in some cases five or six feet.

I cannot conceive how this phenomenon can take place if the excitement is caused by friction of the particles of water in the tube, as in that case I believe the strongest development of electricity would be at the mouth of the tube or boiler; but it fully agrees with the hypothesis that the phenomenon is caused by the expansion and contraction of the particles of steam.

All the experiments on the subject show, that the steam within the boiler is not electrified, and that the electrical development takes place on its escape from the mouth of the tube. At this point, there is an enormous expansion of the steam; and it then takes up its portion of electricity according to its expanded surface, in the same proportion as the electrical state of the boiler, or rather the issue tube. If the boiler or tube be insulated, they will be rendered negative; the steam at this point is so also; but, as it begins immediately to condense, it is, at a short distance, neutral; and, on a further condensation and subsequent diminution of surface, the steam becomes positively electrified.

The cause of the increase, through friction, of the electricity of steam, is probably from its bringing a greater quantity of the steam in contact with the issue tube; thus enabling a greater portion of the steam to take up its coating of electricity than could be the case if escaping from a round smooth aperture; as, in that case, owing to the non-conducting powers of *high pressure* steam, only the exterior particles of the column of steam could take their full coating of electricity.

The presence of water in the tube may increase the electrical development, by rendering the connecting and issue tube a better conductor of electricity from the boiler to the mouth of the issue tube.

The necessity for the issue tube being a good conductor of electricity is shown by the experiments of Dr. Faraday, who says, "A metal, glass, or box-wood tube, well soaked in distilled water, being used for the steam issue, the boiler was rendered well negative, and the steam highly positive; but if a quill or an ivory tube be used, the boiler received *scarcely any change*, and the stream of steam is also in a neutral state."

This must be owing to the difference in the conducting power of the various tubes, and not to the difference in the friction they occasion, as metal, wood when well soaked in water, and glass when it becomes damp from the steam, are good conductors, and would supply the escaping steam with electricity; but quill and ivory being non-conductors, and having a tendency to resist dampness, would prevent the supply of sufficient electricity to cause any strong development.

Every insulated substance held in the current of steam from ivory or quill tubes became negatively charged, from the steam taking off a portion of their electricity.

That electricity cannot be obtained from currents of low pressure steam, may be accounted for by the increased conducting power of steam in this state preventing any development of electricity in the condensed steam, by conducting the electricity back to the boiler the instant any accumulation takes place; even the addition to *high pressure steam* of any saline or other substances (which increases the conducting power of water) prevented electrical development.

It is difficult to account for the absence of electricity when the valve of the boiler was lifted, in Dr. Faraday's experiments, as both Mr. Armstrong and Mr. Pattison performed most of their early experiments from the safety valves of several boilers, and Mr. Armstrong states that on one occasion "the engine was rendered *intensely* negative by a copious emission of steam from the valve." It may be owing to the small pressure on the boiler used by Dr. Faraday.

With respect to the cause why oil of turpentine, olive oil, &c., render the steam negative, I can form no opinion, but I believe that any substance which would reduce the conducting power from the boiler to the mouth of the tube, in any great degree, would render the stream of steam negative, by preventing the particles of steam from obtaining their coating of electricity.

The increase of electricity, with the increase of pressure on the boiler, may be accounted for: as the expansion of steam on escaping from the boiler increases also with the pressure.—*Edin. Phil. Journal.*

WRIGHT'S LEATHER WATERPROOFING PROCESSES.

Sir,—Mr. Baddeley appears to me to be a person desirous of promoting a controversy upon any subject, whether he understand it or not, as is evidenced from other correspondence of his in your Journal, with a hope that he may acquire *some degree of consequence.* I will condescend so far as to contradict his statement relative to Colonel Macerone, and assert that he never pub-

lished, or caused to be published, any directions for a composition at all resembling mine, which I invented and used for my fishing boots in the year 1805, a period, I believe, long before Colonel Macerone was heard of.

Mr. Baddeley should quote from a *correct* copy of my specification. I gave public lectures in chemistry from 1816, during several successive years, and it is not probable that I should, neither did I, in specifying No. 1, direct "*a boiling until a thorough decomposition takes place;*" or, in specifying No. 4, direct the caoutchouc in rectified oil of turpentine to be heated in a sand bath "*till the fusion is completely dissolved.*"

Here ends my notice of the straw-catching Mr. Baddeley.

Now, Sir, to yourself I beg to offer this advice, that you employ some one for your useful and valuable Journal who is competent to copy a specification *correctly*, without placing in the mouth of the specificator statements which would have disgraced Balaam's ass.

I am, Sir,
Your obedient servant,
W. Wright.

3, Great Queen-street, Lincoln's-inn-fields,
November 2, 1844.

[We are obliged to Mr. Wright for his advice; but the fact is, that the blame of the errors complained of does not rest with our copyist—unless fault it be that his handwriting is no plainer than that of the generality of writers for the press. The words "decomposition" and "fusion" were misprints for "incorporation" and "mixture," and we beg, on the part of the printer, to apologize for the misunderstanding they have occasioned.—Ed. M. M.]

THE ATMOSPHERIC MARINE STEAM-ENGINE AND THE "WONDER" STEAMER.

Sir,—Your correspondent "Mercator," in his letter commenting on the speed of the Thames steamers, though very complimentary to the high standing, &c. &c., of the *Mechanics' Magazine*, brings no new fact to this almost exhausted subject. He merely favours us with his opinion that the *Wonder* might not be so very fast as her performances have shown her to be, evidenced though they be by numerous unimpeachable authorities. So far, such kindly suggestions might be permitted to die as they fall, more especially as it would seem by the latter part of his letter that his object was merely to glorify the *Prince of Wales;* but as such assumptions, if uncontradicted, may mislead parties abroad, to whom, as he says, the truth is of so much importance, I will endeavour to remove his doubts on the subject.

And first, with respect to the measured speed of the *Wonder*,—every one must agree that an average taken from a series of alternate runs in the measured mile is the most satisfactory; but there not having been an opportunity for this, the distance was timed through the mile against the tide by several Thames steam-boat captains, and others, (who are certainly qualified to form a good opinion on the subject,) and they were nearly agreed as to the strength of the current, and consequently the rate of the vessel in still water, which is rather understated in the account. But to turn to further evidence:—the boat on her first trial, when not working up to her full speed, in consequence of the wheels not having sufficient dip, easily passed and distanced, in a short run, the *Flying Eclipse*, though the latter was going at her best; and the captain acknowledged that his vessel never went faster. Every exertion was used to prevent the *Wonder* going past; and the *Eclipse*, at the time, was going at the speed at which she beats the *Prince of Wales*, one-half to three-quarters of an hour, to Margate. Besides, the manner in which the *Wonder* passed the best of the Gravesend boats, and beat the royal yacht full an hour from the Nore to Woolwich, must, I think, be held as conclusive on this subject.

With respect to the trial with the *Prince of Wales*, to which "Mercator" adverts, I think he could not have been fully informed of the circumstances. The *Prince*, drawing about 3 feet less water than the *Wonder*, was steered, I believe at some hazard, across the shallows, and by this means saved several miles of distance in the run, and yet was passed and rounded by the *Wonder;* the latter keeping out in the regular channel, and actually having to go sufficiently ahead to turn round, and run directly in shore, for more than a mile, for the purpose. Of course, under such circumstances, it is very difficult to assign the amount of superiority; but it was generally considered on board that the *Wonder* was beating her at the rate of about three miles per hour.

It should be observed that the *Wonder* is built for a sea-boat, and is, in consequence, of immensely heavier scantling than the *Prince*, drawing 6 ft. 6 in.; whereas the *Prince* is exceedingly sharp, and draws under 4 feet.

Since the vessel left the Thames, she has continued to earn fresh laurels, and has proved herself an excellent sea-boat. She

went from the Thames to Southampton (about 200 miles) in 10¾ hours, and from Southampton to Falmouth in 10¼ hours. The shortest passage ever before made between Southampton and Falmouth, was by the *Pacha*, in 16 hours. She also went from Weymouth to Southampton (72 miles) in 3¾ hours, and from the Needles to Southampton Docks (30 miles) in 1 h. 35 m.

In the observations I have made above in justification of the new boat, I beg to disclaim any wish to depreciate the just claims of the *Prince of Wales*, which I think a very fine vessel, and one which does credit to Mr. Pascoe; but, at the same time, I must take leave to inform "Mercator" that the idea of her being a match for the *Wonder* is a great delusion. I am, &c.

R. W.

PERCUSSION SHELLS—MR. MALLET IN FINAL REPLY TO CAPT. NORTON.

Sir,—Referring to Captain Norton's letter in your journal dated October 3, 1844, with regard to percussion shells, I have to observe, that although Captain N. will not admit, in so many words, that the shell produced by him recently to the authorities at Woolwich, and it appears tried with satisfactory results, is identical in principle with that invented by me, and published in your journal in 1832,—still it is plain, from the tenor of his letter, that such is the fact. *There can by possibility* be no other reason for declining answering the question I put to this gentleman, viz., Was his (so to speak) shell, tried as above, identical in principle with mine, as published by you in 1832, or not? No secret could have been revealed by his answering this, except the unpleasant secret—which it is now plain to conviction has been wrung from Captain Norton—that he is an inventor at second-hand, gathering character, and endeavouring to obtain reward, by knowingly producing and promulgating as his own, to the authorities of the Ordnance, and to the public, the invention of another.

I say there could have been no other secret injurious to him revealed by a straightforward answer; for if *his* (so-called) percussion shell was *not* identical in principle with mine, so that he could have said so with truth, his secret invention, if he had any, might have remained secret. If it *was* identical, then he had no secret to retain; but in saying so he would have pleaded guilty to that which his letter of October 3, 1844, equally convicts him of—*plagiarism*.

As to Captain Norton's lame attempt *now for the first time*, at the eleventh hour of this correspondence, to make out a claim to *priority* of invention in this matter, by saying, that in 1823, he used a suspended bar to explode percussion powder in the bottom of a *gun barrel*; and in 1824, used an *ouncel* to effect the same, it might most reasonably be demanded after what has passed, that *evidence—testimony* should be adduced as to these being facts, if they had anything whatsoever to do with the matter in dispute; but as the lawyers say, these circumstances are "irrelevant and impertinent." Neither suspended bars in gun barrels nor spring ouncels constitute the invention which I claim, and which Captain Norton has endeavoured to usurp, (to use no harsher term,) namely, the application of the principle of the inertia of a loose internal piece to the explosion of shells on their flight or fall being arrested by an obstacle. But further, I beg most unconditionally and explicitly to deny the fact which Captain Norton gives "to the best of his belief and memory,"—viz.; that he communicated to me in 1832, these gun barrel and ouncel schemes of his, now for the first time even hinted at; he never before so much as mentioned that he had ever entertained any thought of a method of exploding shells, or anything else like that which I showed to him and his friend Major Cottingham in 1832.

The latter gentleman is forthcoming to contradict me, if *my* memory be here defective. Thus, then, this ingenious but uncandid attempt to turn the tables, and put *me* in the light of the plagiarist, fails; first, because irrelevant, and next, because unsustainable in facts.

But, lastly, if all Captain Norton's assertions were admitted, it is beyond the possibility of denial, that I was the first to *publish* in your journal the invention of the application of the principle of inertia to the ignition of shells, and as "second inventors have no rights," so the utmost that the most prejudiced friend of Captain N. could claim for him, is that he re-invented that which another had invented and published ten years before him; but, even this much I cannot concede to him, for here again, I affirm, that in 1832, I fully detailed to him and his friend Major (then Captain) Cottingham, the whole construction and principle of my shell, as published by you in that year.

I have only to add, that the heads of the Ordnance department shall be by me informed of these circumstances, as well as the public at large, in the pages of other journals at home and abroad.

I am, Sir, your most obedient servant,

ROBERT MALLET.

Dublin, November 4, 1844.

NOTES AND NOTICES.

The Great Britain has been at length floated from the dock where she has been so long confined into Cumberland Basin. She is to make an experimental trip or two in the Bristol Channel, and after that to be brought to London.

The Empire (United States) steamer, is said, in the American papers, to have made the run from Chicago to Buffalo, 1072 miles, in 75 hours, deducting 10 hours for stoppages at the different ports, being equal to 14 miles three-tenths (nearly) per hour.

London and Philadelphia Line of Steamers.—The editors of the Philadelphia papers are urging upon their capitalists the establishment of a line of Atlantic steam ships, to compete with those of Boston and New York. If not yet provided with suitable names for them, we would recommend them to call the first "The Repudiator," and the next "The Sydney Smith."

New Solder.—Dissolve zink in muriatic acid to saturation; add pulverised sal ammonia to this solution, and after boiling it for a short time, it is ready for use. In using this compound, no cleaning of the metal is necessary, however oxidized, and oil and other materials are dispensed with. It is only necessary to apply with a piece of sponge upon a stick or a feather this solution to the part to be soldered, in place of the material now used, to prevent oxidation and facilitate the flow of the solder. Such is the efficacy, that if two pieces of bar, possessing considerable surface, be wet with this solution and pressed together, upon the application of the soldering tool the solder will at once flow between the plates throughout.

Misdirected Ingenuity.—Mr. Warner, an ingenious watchmaker and jeweller, who occupies a stand at the Polytechnic Institution, has completed the model of a high-pressure steam-engine—so small, that it stands upon a fourpenny piece, with ground to spare! It is the most curious specimen of minute workmanship ever seen, each part being made according to scale, and the whole occupying so small a space that, with the exception of the fly-wheel, it might be covered with a thimble. It is not simply a model outwardly, it *works* with the greatest activity, by means of atmospheric pressure (in lieu of steam) and the motion of the little thing as its parts are seen labouring and heaving under the first influence, is indescribably curious and beautiful. Some months have been expended upon the structure of this lilliputian engine by Mr. Warner; and the difficulty of the undertaking may be easily conceived, when it is remembered how minute the valves, pistons, sockets, screws, and hidden apparatus must be, and how accurately they must be moulded and fitted, to insure unbroken functional motion. It is altogether a pretty toy, and an extraordinary instance of what patience, perseverance, and expert artizanship, can accomplish. But Mr. Warner is a practised hand at such curiosities. His cases abound with articles manufactured for elfin use. He has scissors so minute, that some hundreds of them go to the *ounce;* and there are knives belonging to the same family, which, small as they are, open and shut with a smart click. Quantities of other things are there of a like kind, made with the greatest neatness, requiring eyes of microscopic clearness, to ascertain their full perfections. Mr. Warner, we should imagine, works exclusively for the fairies—no doubt he is entitled by letters patent, to wear Oberon's arms over his door.—V. N.

Simple Mode of Purifying Water.—It is not so generally known, as it ought to be, that pounded alum possesses the property of purifying water. A table spoonful of pulverised alum sprinkled into a hogshead of water (the water stirred at the time) will, after the lapse of a few hours, by precipitating to the bottom the impure particles, so purify it that it will be found to possess nearly all the freshness and clearness of the finest spring water. A pailful, containing four gallons, may be purified by a single teaspoonful.—*Southern Planter.*

The Gladiator steam-frigate recently launched at Deptford, is fitting with engines by Messrs. Miller, Ravenhill, and Co. They are of 430-horse power, and have been constructed on the plan, for which Mr. Miller has a patent. The cylinders are 78½ inches in diameter, and 5 feet 9 inches stroke; they are furnished with Howard's patent condensers. The air-pumps are placed in an inclined position between the cylinders, in the centre line of the vessel in a fore and aft direction—an arrangement which is of marked advantage in sharp vessels, and in war-steamers, where deck-room and coal space between the ship's sides, is important, as it enables the engineers to place the cylinders nearer to each other, and at the same time, lower down in the vessel. The *Black Eagle's* pumps are arranged in the same manner; so are those of some of the Watermen's boats of late date. Ordinary or side-lever engines, of the power of those made for the *Gladiator,* would occupy 27 feet of the length of the vessel, in its best part, and weigh, at the lightest, with common boilers, and water in them, from 430 to 440 tons. But the engines of the *Gladiator* will occupy only from 18 to 20 feet of the length of the vessel, and, with tubular boilers, water included, no more than 275 tons.

Interior of the Earth.—The increase of temperature observed in mines is about one degree Fahrenheit for every fifteen yards of descent; and should the increase go on in the same ratio,

Water will boil at the depth of 2430 yards.

Lead melt at the depth of 8400 yards.

Everything be red hot at the depth of seven miles.

Gold melt at the depth of twenty-one miles.

Cast-iron melt at the depth of seventy-four miles.

Soft iron melt at the depth of ninety-seven miles.

And at the depth of 100 miles there must be a temperature equal to the greatest artificial heat yet observed—a temperature capable of fusing platina, porcelain, and, indeed, every refractory substance we are acquainted with. These temperatures are calculated from Guyton Morveau's corrected scale of Wedgewood's pyrometer; and, if we adopt them, we find, that the earth is fluid at the depth of 100 miles from the surface—and that, even in its present state, very little more than the soil on which we tread is fit for the habitation of organised beings.

Electro-Telegraphy.—An electro-magnetic telegraph on Mr. Faraday's plan, has been attached to the Taunus railroad, which lies between our city and Frankfort on the Maine, the extent of which is about 16 French leagues. *Letter from Mentz in the "Journal des Debats."* What is Mr. Faraday's plan? We never heard of his having any.

Fall of a Mill from Defect in Construction.—Twenty persons have been killed by the fall of a mill, at Oldham, belonging to Messrs. Radcliff. Messrs. Fairbairn and Bellhouse, engineers, who were requested by the inquest jury to examine the premises, reported, that the accident had arisen from "defective knowledge and skill in the construction of the building," and the jury found a verdict accordingly. The Report, which is drawn up with great ability, and is of universal interest, shall be given at length in our next.

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Mechanics' Magazine,

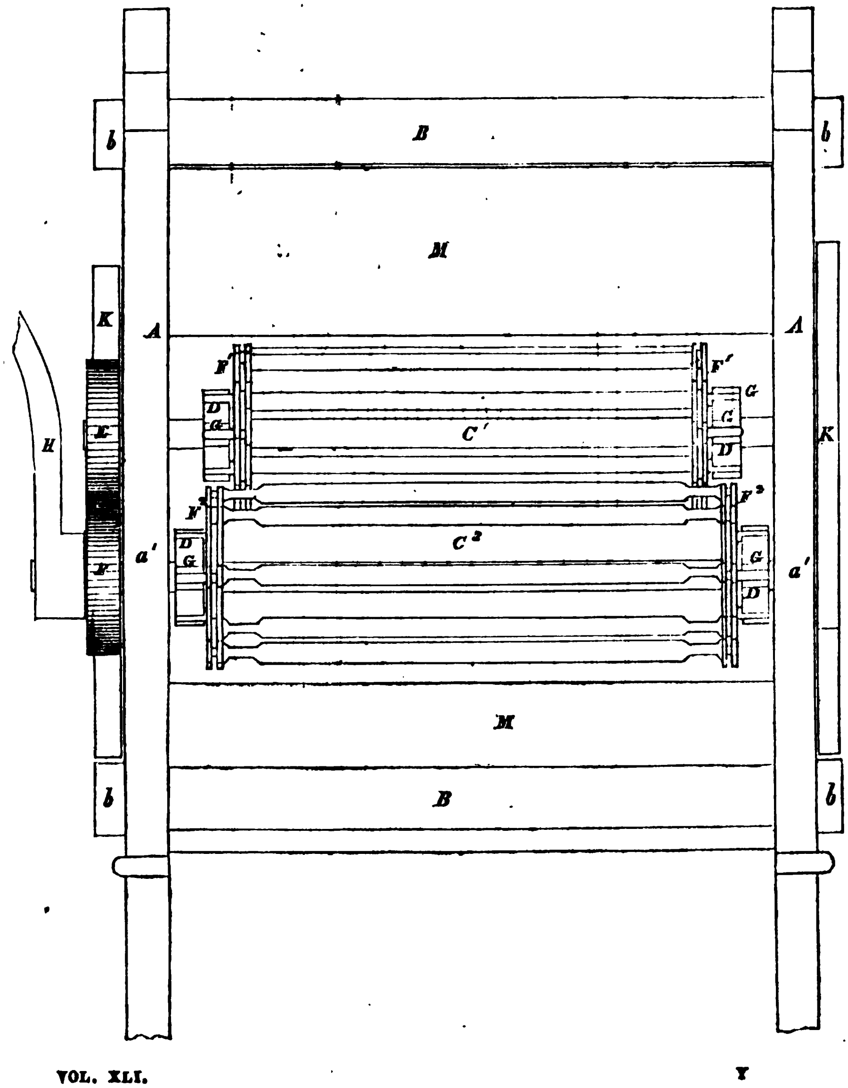
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1110.] SATURDAY, NOVEMBER 16, 1844. [Price 6*d*.

Edited by J. C. Robertson, No. 166, Fleet-street. Double.

HUGHES'S PATENT ROUCHE-MAKING MACHINE.

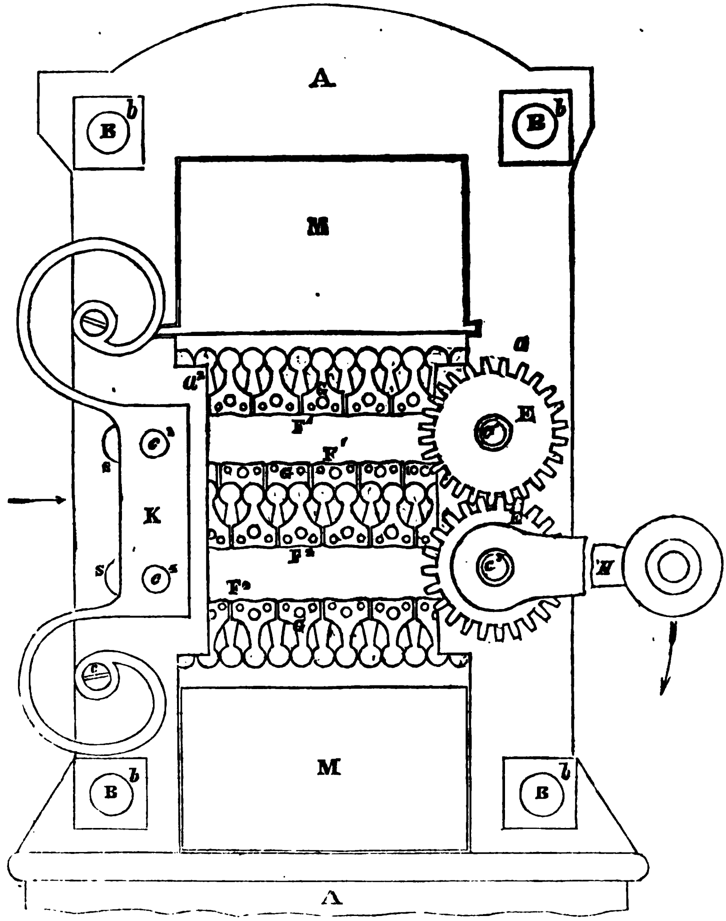
Fig. 1.



HUGHES'S PATENT CRIMPLING, FLUTING, AND QUILLING MACHINE.

[Patent dated, May 15, 1844; Specification enrolled, November 2, 1844. Patentee, Hesketh Hughes, Chiswell-street.]

Fig. 2.



Ruffs or rouches, though of no small antiquity, and always since their first introduction more or less in demand—fashion having never interfered with their popularity farther than to vary their forms, or to limit them in point of size—have never till now been manufactured by machinery. Mr. Hughes claims, and we believe truly, to be the first who has ever made a machine for the purpose. The results are such as usually attend the supercession of hand labour by mechanical power, and which, though in their first operation, inevitably productive of a considerable amount of individual hardship, are sure in the end, by increasing the aggregate resources of society, to be of general benefit. The

most expert female cannot by the closest application for twelve hours a day, produce more by hand than twelve boxes of goeffered blonde, containing 24 yards each, or 288 yards in all; while a single machine, such as we are about to describe, will produce with ease 100 boxes of the like article, or 2,400 yards. The machine article, as may be readily supposed, is also much superior to the hand-made, in point of uniformity and finish.

Fig. 1 is a side view, and fig. 2 an end view of this machine. A A is the framework, which consists of two sides, each cast in one piece, connected together by cross bolts B B, made fast by screw nuts *b b*. C^1 C^2 C^3 C^4 are two pairs of axes, which have their bearings in the four pillars a^1 a^1 and a^2 a^2 of the framework, the one fixed at a little distance above, and exactly parallel to the other. The whole of these axes are free to

Fig. 5.

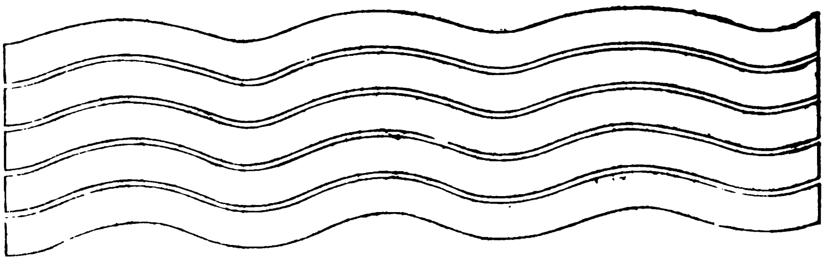
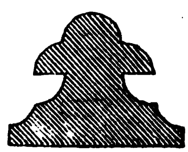


Fig. 6.

move in their bearings when acted on in the manner to be presently explained. The axes C^1 and C^3 carry each two pinions D D inside of their respective bearings, and each has at one end (prolonged for the purpose), on the outside of the framework, a cog wheel E, keyed to it. The two wheels E are of the same number of cogs, and work the one into the other. F^1 F^2 are two endless chains of rods, the former of which is carried round the axes C^1 and C^2, and the latter, round the axes C^3 and C^4. The rods of these endless chains are connected at the ends by double rows of links of the peculiar form shown in fig. 1, and more particularly in the detached view of one of these chains given in fig. 3; the rods being connected to the inner and outer rows of links alternately, as is also clearly shown in the separate plan of a portion

Fig. 6².



of one chain given in fig. 4. The rods of the upper chain F^1 are made shorter than those of the lower chain F^2, in order that when the two chains are made to revolve the rods of the upper may link into the open spaces between the rods of the lower. G G are a series of projecting catches which are riveted to the outer rows of links, and take into the teeth of the pinions D D. H is a crank handle, by means of which the axis C^1 is turned round, which imparts a rotary motion through the medium of the cog

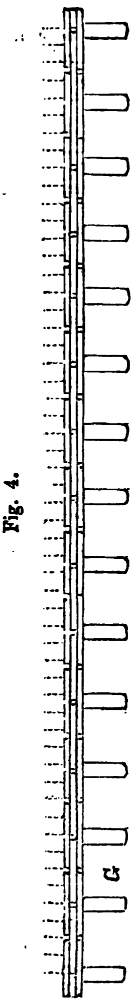


Fig. 4.

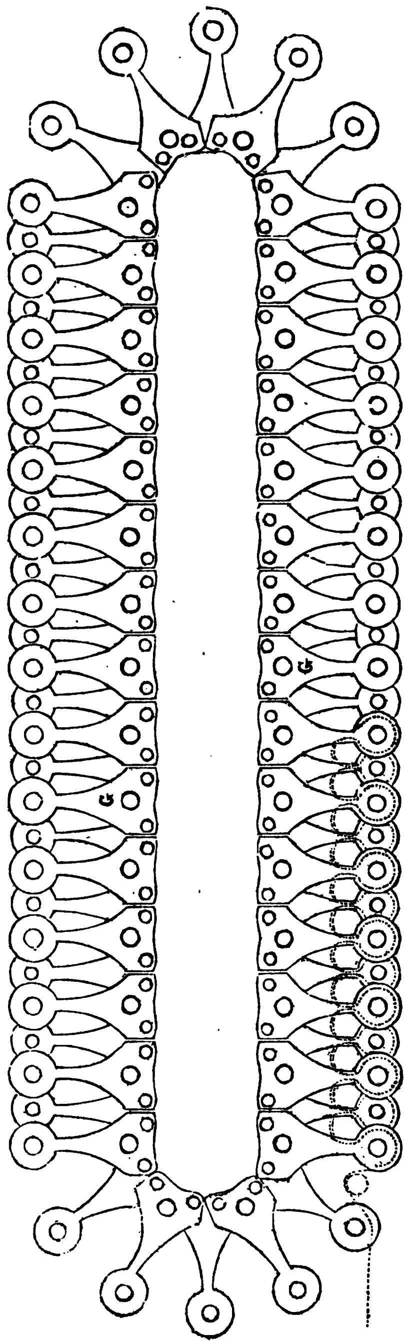


Fig. 3.

wheels E E, the catches G G, and the pinions D D, to the axes of the pinions C^3 C^3, and the endless chains of rods F^1 F^2.

The piece of muslin or other fabric to be operated upon, is introduced at one side between the revolving chains of rods, in the direction indicated by the arrows, and comes out at the other in a figured state.

If the rods are of a plain circular form, such as those shown in the figures, the work will be of a plain fluted description; but the rods may be made of various other forms, as, for example, the waving form represented in figs. 5 and 6, or of any other form or forms which will admit of the projecting parts of the one set of rods taking into the receding parts of the others. And the distance between the flutes or waves, or other raised portions of each pattern, may also be varied by increasing or lessening the width of the links by which the rods are connected. If the muslin or other fabric be passed through the machine in a direction exactly parallel to the two sides, the flutes, waves, or other figures, will run straight across the piece; but by giving the piece of goods (when the length of the piece, or width of the machine, will admit of it) an inclination to the one side, or an inclination to the one side and the other alternately, they may be all inclined in one way, or alternately inclined in opposite directions.

To keep the endless chains tight, and to accommodate that tightness to the quality of the fabrics passed between them, there are two spring regulators, K K, slipped over the ends of the axes C^3 C^4, outside of their respective bearings, and made fast to the back pillars, a^2 a^2, of the framework, by the screws *c c*; the ends of these axes resting in slots *s s*, which admit of their being moved forwards or backwards to the extent of these slots, as shown in fig. 2. M M are two metallic cases, one placed above the upper chain of bars, F^1, and the other below the under chain F^2, for the reception of heating irons, by which the rods, as they pass over and under them, are sufficiently heated to give a proper set to the muslin or other fabric.

OLD BOOKS.—INQUIRY ANSWERED.

Sir,—I have recently written to Mr. Woollgar, soliciting information from him respecting a catalogue of the stars, which, I have a pleasure in stating, that gentleman promptly afforded me; and moreover, seeing my inquiry about the author of a valuable old book, he very kindly favoured me with the following P.S. upon the subject, dated Nov. 6, 1844.—J. Loose.

"P.S. If Mr. Loose is the querist at p. 294 of the last week's M.M., I can inform him that the author of the 'Arithmetic' he describes was one John Hill, and that the date assigned (to the first edition), in Watt's *Bibliotheque Brit.* is 1716. My copy (10th edition) is dated 1761.—J. W. W."

LIGHTNING CONDUCTORS.—INSULATION AUTHORISED.

Sir,—I have read in the *Times*, and subsequently in your Magazine, Mr. Walker's interesting description of his lightning conductor at the new Royal Exchange, most of the details of which are highly creditable to the skill and foresight of Mr. Walker. Upon the one point, however, on which we have agreed to differ, I must be permitted to say a few more words. I have complied with Mr. Walker's somewhat *Irish* advice, to consult the standard authorities—who are silent on the question at issue! Such is the fact, as admitted by Mr. Walker, with *one* exception, which would seem to have escaped his notice. This authority is no mean one, nor is it buried in any antiquated or obsolete work; in the recent edition of the "Encyclopedia Britannica," article, "Electricity," is a description of the best form of lightning conductors for houses, in which occurs the following passage—

"The iron staples which fasten them to the wall should be considerably larger than the rod, and *should be covered with two or three folds of woollen cloth steeped in and coated with melted pitch.*" I need not observe that the object of this coating was *insulation*. The case does not, therefore, stand exactly as Mr. Walker ingeniously puts it; but as follows, viz., the Encyclo. Britan. Professor Murray, and Mr. Baddeley on the one hand, *v.* Mr. Walker and the *silent* authorities on the other!

It is certainly very singular that so many able writers on the subject should have left the matter of *insulation* an open question, while all the other details have been so carefully and so minutely noted. Under such circumstances surely the matter may be discussed without *loss of temper*.

I have an important suggestion on the subject of lightning rods, which I will embody in another communication at my first leisure.

Yours respectfully,

W. Baddeley.

29, Alfred-street, Islington, Nov. 13, 1844.

EXAMINATION OF THE COMPARATIVE MERITS OF THE PUMPS OF CTESEBES, GOSSET, AND SHALDERS.

Fig. 1.

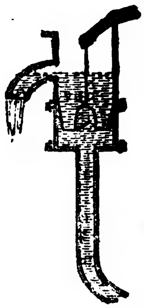


Fig. 2.

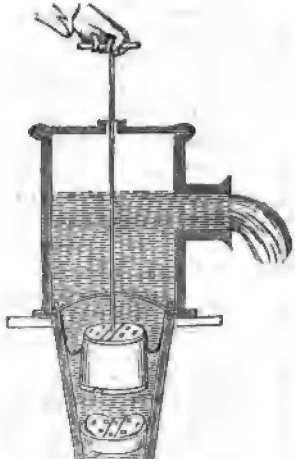
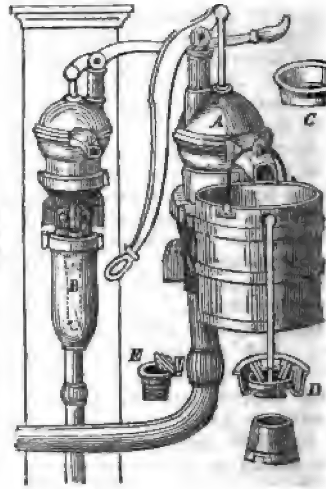


Fig. 3.



The common sucking pump is the best of the friction family. The plunger pump requires its rod to be guided downwards, which involves a waste of power. The lift force pump has the additional friction of a stuffing box. Ctesebes's cylindrical pump, under every adaptation, absorbs a great deal of power by friction, rarely less than 40 *per cent.*—it progressively falters by leakage, and it is liable to get choked and injured. Every variety, in short, of the friction pump is but a poor contrivance for raising water, which it literally hoes up with a scraper.

Ewbank (Treatise on Hydraulics) pronounces Gosset's (fig. 1 of the accompanying sketches) to be the most efficient and durable of all pumps, but seems afraid it should dip above 8 inches (page 208). A Shalders' fountain pump of the sort, fig. 2, upon the smaller graduated scale, dips 21 inches and delivers 28 imperial gallons of water per stroke. Ewbank ought to know that Gosset's pump never acted well; indeed it is utterly impossible it ever should, because its leather is suffered to flap about in the cylinder entirely unsupported.

But although Gosset's pump can never produce good action, nor Ctesebes's good effect, Shalders's pump produces both; and has been proved by abundant evidence to be by far the most durable of the three. Its water ways are so large, that there is no check to velocity, so much so, that when the force greatly exceeds the resistance, the pump in some instances delivers 150 per cent. over its legitimate quantity; that is, instead of 2 lbs., it delivers 5 lbs. of water per stroke.

A pair of No. 8, fountain pumps worked by steam power at Saint George's Dyery, Norwich, augment their delivery by velocity from 40 to 66 lbs. of water per double stroke, and in 1837, filled a 35 barrel tank in 4¾ minutes. A treble set of brass pumps, which they superseded, took from 20 to 30 minutes to fill the same tank, and wanted new leathers four times as often as the present fountain pumps. The establishment referred to frequently requires above a thousand barrels of water in a day.

The dilator, or air vessel, (see fig. 3,) has an extraordinary influence, and is a most interesting part of the pump. A No. 16, with a 4½ inch dip, a 3 lbs. delivery, and drawing water 26 feet perpendicularly through an inch feed-pipe, acted well when worked under 32 strokes per minute. If worked over that speed it jolted and faltered, but with a dilator it acted well when worked at above 100 strokes per minute.

In figure 3, A represents the pump; B, the dilator; C, the connector; D, the

connector and expressor, E the lower valve.

The largest tanner in Norwich calculates that his seven fountain pumps have saved him in wages above 1000*l.*

One at a maltster's at Wrotham, delivers a barrel of water in a minute; three-fifths of it by velocity, thereby saving both metal and money, in the less size of the pump.

Six of these fountain pumps have watered the streets of Great Yarmouth for eight years, to such advantage, that the water carters pass the poor friction pumps as we pass an old friend when he has spent his last shilling.

Ten of them, varying in length from 15 to 90 feet, have watered the roads through Windham to Cringleford, a distance of seven miles, for eight years, and have proved altogether indispensable; for had they not displaced the long friction pumps, the undertaking of watering these roads must have been abandoned. Of these ten fountain pumps, and seven upon the Aylsham road, there has been one only that wanted new leathering at starting this year, although every friction pump (a larger number) upon the last road was out of order.

It costs less to keep seven fountain pumps in constant, perfect action, than two friction pumps in their best state constantly working.

In May 1841, Mr. Shalders fitted the public well of the parish of St. Michael's, at Plea, Norwich, with a pump 60 feet in length. Although the water delivered by the former pump was commonly cloudy, that delivered by the new one has been uniformly clear, and raised with half the labour. Within thirty years three friction pumps had been fixed in this well, which is in the centre of 66,000 inhabitants, and free to all. The last was a best brass London pump; but none of these three pumps would stand the almost incessant working for six months without faltering 30 per cent. Nevertheless, the fountain pump (the easiest and cheapest repaired of all long pumps,) performed the same work for twenty months without faltering, besides having to furnish a large additional supply for watering the streets.

No work has been so badly done as that of raising water; no public pumps are worse than those in, and about London. Walking lately from London bridge to the Tunnel, I was pained to witness two strong men labouring hard at one of the best street friction pumps for seven minutes, to raise six barrels of water 13 feet high, when one man could with a fountain pump have done the work with ease in half the time.

The following are short rules for adjusting pumps to the full average maintaining-power of a man:—With friction pumps 120 lbs. of water can be raised 1 foot each full stroke of a lever; with fountain pumps, 200 lbs. Divide these numbers by the number of feet the water is to be raised, and it will give the right quantity in pounds for both pumps, to any height required. Thus—if 20 feet high, the friction pump should deliver 6 lbs., and the fountain pump 10 lbs. of water each full stroke.

The services of the fountain pumps at fires have been many and important. One or two examples may suffice.

The cavalry barracks, Norwich, took fire. "We believe," says the *Norwich Mercury*, "that we do not in the least degree exaggerate the credit due to Mr. Shalders, jun., when we state, that it is to his own exertions and the great efficiency of four of his hand-power fire engines, that the officers' residence was preserved. These were handed up the ladders to the top of the officers' dwelling, where Mr. S. quickly showed the soldiers on the roof how to work them from the water dammed up an inch or two deep in the surrounding gutters. Thus, a great deal of the water delivered inefficiently by the city engines was worked most effectually over again, in quenching the burning embers falling on the blankets with which the most exposed parts of the roof was covered, and not a spot of which was left unsoaked."

Another fire broke out on the grocery premises of Messrs. Butcher and Son. On opening the door of the storeroom, where the fire originated, the flames burst forth full 30 feet, and knocked down Alderman Butcher. The whole storeroom then appeared like a steam-engine furnace in full glow. William and John Shalders, each with an engine in hand, and at the risk of their lives, instantly delivered into the flames such uniform and impetuous streams of water, that the fire was fairly banged out before the city engines could be brought into action, which was seventy minutes. In the

midst of the conflagration some one called out "there is over the fire some hundreds of pounds of gunpowder." This was soon after brought into my court; like a good tory, however, I instantly thought of the church, and conveyed the gunpowder thither. Had not the fire been quickly arrested this powder must have exploded with certain destruction to Messrs. Butcher's and the adjoining houses, whilst their flaming and dense materials would probably have spread destruction and death far around. Happily the Hydraulic-street fountain pump was at hand, and in the hour of danger and of terror supplied 30 gallons of water per minute for the engines, which kept the damage under 500*l*., and prevented a most awful calamity.

I am, Sir, yours truly,

W. SHALDERS.

Sept. 24, 1844, Bank-place, Norwich.

THE ARGAND FURNACE AND SMOKE NUISANCE PREVENTION BILL.

Sir,—Perhaps *no* reply were the most suitable answer to the coarse diatribe with which your correspondent Mr. Dircks has favoured me and your readers, under date of 4th October, 1844. I have drawn public notice to the claims of M. Virlet to be henceforth considered as a prior inventor of the method or principle (as it is called) of mixing or diffusing the air and combustible gases in furnaces, by causing the former to enter at a particular place, and by numerous small apertures. I have referred all persons interested in the matter to the original Memoir; and I have now done with the subject, quite content that Mr. Dircks shall enjoy the "opima spolia" of which controversialists of his class are so fond, namely, the last word.

I would first, however, just remark, that Mr. Dircks's last letter does not contain a single syllable to the purpose; and hence there is nothing to reply to beyond the correction of one or two gross misstatements.

I have *not* stated in mine of Sept. 16, that Mr. Williams's treatise is mischievous on account of its imperfect and superficial statements; though this might not have been very far from the fact; but I have stated, and I repeat, that "his book is mischievous on account of its imperfect and superficial *statements of the chemistry* with which it so much and so unnecessarily meddles."

Next, Mr. Dircks is grievously hurt at my statement that he considered carbonic oxide as the only gas given off by timber when burnt. The passage which gave rise to this occurs in Mr. Dircks's letter of July 30, 1844, where he says, "In his," Mr. Williams's "air-diffusion apparatus, a good draught is requisite, because *he* is dealing with the smoke-making coal gas, which requires double the quantity of air, compared with the smokeless carbonic oxide consumed in M. Virlet's process." I plead guilty to having *inferred* from this that Mr. Dircks concluded that Virlet's furnace was fed with wood, and carbonic oxide alone produced. What he *did* infer, or what he meant, I now really cannot divine; but the statement is plain enough that he affirmed that nothing but carbonic oxide was consumed in Virlet's furnace; and this is contrary to fact, in any furnace, whether fed with coal, coke, turf, charcoal, or wood.

These are the only two sentences in Mr. Dircks's production that seem to require notice; the main question of Virlet's and Williams's claims, I am ready to leave to futurity.

It might be very gratifying to Mr. Dircks to know who I am; but I do not see its bearing on the matter in hand. I have no personal motives for or against either him or Mr. Williams. His opinion of my chemical acquirements I am quite willing to leave as untouched as his high estimate of his own.

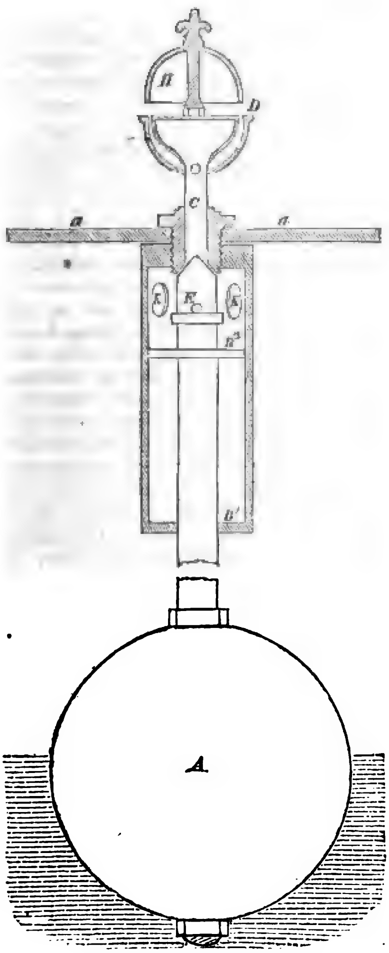
I am not a dabbler in furnaces; but I do know something in theory and practice of the manufacturing arts of Great Britain; and I know that many of these demand applications of heat from coal, in which perfect combustion, or even an approach to it, is tantamount to failure in the end required, when a constant excess of carbon is indispensable. I know, moreover, that *black coal smoke* is about the least injurious to health or vegetation of any volatile product of our chimneys; that the carbonic acid of perfect combustion, the muriatic acid of alkali works, the arsenious and fluoric acids of the copper works, the sulphurous acid of these and others, are all more injurious, and cannot be avoided by act of Parliament, unless industry is to be annihilated. I know that the most perfectly *doctored* furnace that Mr. Dircks, or Mr. Williams, his patron, can construct, will smoke plentifully at the neglect of the stoker, or at a hundred other contingencies; and therefore it is that I repeat that the projected smoke-consuming bill, if ever passed, (which Providence avert!) will be found a grievous burden; and I would take advantage of the wide circulation of your pages here to warn all concerned in the consumption of coal for manufactures, that *this bill is a job got up by the smoke-burning patentees, and other interested par-*

ties, for the express purpose of saddling the public with their nostrums by the strong arm of the law; and that if such a measure as was proposed last session become law, an amount of injury, annoyance, difficulty, and trouble, now incalculable, will be inflicted upon the industrial interests of the kingdom, Mr. Dircks, and other such *disinterested* witnesses, to the contrary notwithstanding.

IGNIS.

ALLEN'S ANTI-EXPLOSIVE ALARM WHISTLE.

[Registered under the Act for the Protection of Articles of Utility. Job Allen, of 20, Bower-street, Commercial-road East, Engineer, Proprietor.]



Description.

The object of this instrument is to prevent injury to boilers from the water falling below its proper level.

A is a float attached to a stem or rod, which passes upwards through a tube, B^1, and a diaphragm, B^2, fixed within that tube, and terminates in a conical top, which fits into the hollow pipe, C, of the steam whistle D. The lower end of the whistle D is passed through an orifice in the top of the boiler (indicated by the letters *a a*), and screwed into the top of the tube, which is thus kept steady, if in a vertical position. E is a collar attached to the stem of the float, near to the top, which, catching against the plate B^2, on the fall of the stem or rod A, prevents it from descending farther. When the water falls below the safety line, and the float along with it, the descent of the steam of the float opens the pipe C of the whistle, and allows the steam to escape, which, impinging against the bell H at top, produces the alarm required. K K are orifices in the side of the tube to facilitate the rushing of the steam into the whistle, as soon as the boiler is in danger.

THE COPYRIGHT OF DESIGNS, AND SOME RECENT MAGISTERIAL DECISIONS.

Sir,—In the following remarks on the Registration Acts, I disclaim any intention of making a personal attack on any one.

In designs merely ornamental, the outward and manifest shape and configuration are their essential characteristic; and the deciding upon what are like or unlike may in general be safely confided to any two persons of ordinary or extraordinary capacity. On the contrary, the essential and important shape and configuration of an article of utility is not by any means necessarily outward and manifest, but may be such as can only be correctly appreciated by persons conversant with articles of its class; and, therefore, if any dispute arises about such an article, the most fit persons to decide it, are those who by trade and habit are familiar with articles of its class. But this is an equitable mode of settling disputes, which can scarcely be hoped for in the present day; while there is a probability of one pleader obtaining a fee for misrepresenting the law, and of a second pleader getting another fee for standing

bye, and allowing the first to say what he pleases uncontradicted, things may be fully expected to remain as they are.

I suppose we are bound in courtesy, if for no better reason—and notwithstanding the notorious and detestable prevalence of class legislation in this country—to suppose the Useful Designs Act was passed with the honest intention of rewarding the ingenious but poor artist, and thereby inducing him to exert himself for the benefit of the community. Let us concede this, and examine how the intention has been carried into effect. It has been left to be *imagined* or *guessed at* whether the "shape and configuration" upon which the protection depends, be the *essential* or the *accidental* shape and configuration. It is true we are bound to suppose the first is *intended;* because, to suppose the *accidental* shape to be the one contemplated by the Act is tantamount to believing it framed for the purpose of inducing confiding people to pay ten or fifteen pounds for a protection, which, in the great majority of cases, could not be any protection at all; but nothing is said on the subject, and the persons appointed by the Act to settle disputed points, are those most likely to prove unable to comprehend the merits of the question on which they have to decide, and who are in every way irresponsible for their decision. The direct consequence of all this is to encourage piracy, impoverish inventors, and put money into the pockets of the lawyers.

For my part, I feel benefited by a recent decision, not because I feel any thievish propensities stimulated and encouraged thereby, but because I contemplated registering more than one contrivance, and now perceive that I had better keep my money in my pocket, and my contrivances to myself; for they are unquestionably mechanical contrivances, and it appears to have been asserted and suffered to pass uncorrected, that mechanical contrivances—however simple—cannot be protected by registration. It is true, the Act makes no such exceptions; but what does that signify? It would not be difficult to find practitioners who would pretend to know more of the intentions of the legislature, than it has chosen to explain in the Act, and who would say such articles *are* excluded; and it would probably be as easy to find magistrates who would be guided by the *dictum;* and where is the protection I should have paid for, and what is it worth?

If it were not for the grave consequences of these aldermanic decisions they would be highly amusing. In one that was given not long ago it seemed quite beneath the mighty mind of one alderman to attend to the real merits of the question at issue, which was simply *whether an act of piracy had been committed or not;* for he appears to have been interestingly engaged in forming his own estimate of the importance of the article that money had been paid to protect, and in speculating on what the legislature *intended*, instead of confining his attention to what it had *enacted*. He thought the article "too trivial a matter to be the subject of copyright," and that "the object of the Act was to secure reward to great skill and ingenuity," meaning, of course, to confine its operation to such things as magistrates were of opinion, exhibited sufficient "skill and ingenuity" to entitle them to patronage. But the other worthy alderman happened to live in a ward where "many of the inhabitants were engaged in trade that required the constant protection of the law to their original patterns," and *therefore* a decision was given for the plaintiff. In a more recent case, the worthy aldermen improved upon the former procedure. They gave a decision—apparently without the least suspicion that their reasons for it could be of any more consequence to other people than to themselves—and they seem therefore to have decided without any reason at all. At all events, when asked for their reason they returned an answer which embodied all the wisdom and dignity of—"Don't you wish you may get it."

Yours, &c.,

S. Y.

[We think our correspondent ascribes undue importance to the circumstance of the random remark of Mr. Clarkson (*in re* Wolferstan *v.* Warner and Sons), that the Designs Act was not intended to embrace mechanical action, having passed uncontradicted. Did the observation *need* any contradiction? Can anything be more manifest (except, perhaps, to certain worshipful dunderheads) than that "shape and configura-

tion" must of necessity embrace, in a vast number of instances, "mechanical action" in the strictest sense of the term? What is a wedge, or a screw, or a key, but an instrument depending entirely for its mechanical power on "shape and configuration?" Why are wheels circular, and the peripheries of some flat, while those of others are bevelled? The teeth of some wheels rectangular, and others epicycloidal? Some valves cylindrical, others conical? In short, the cases of mechanical invention are innumerable in which the "shape and configuration" is the all in all. Our correspondent, as well as every one else who likes to see right and justice prevail, will be glad to learn that the question between Mr. Wolferstan and Messrs. Warner and Son is not to rest where it is; but that it is intended to obtain, by an action at common law, the judgment of one of the higher courts upon it.—Ed. M. M.]

COLONEL MACERONE'S (ALIAS WRIGHT'S PATENT) WATERPROOF LEATHER.

Sir,—I hasten to apologise to Mr. Wright for the *levity* of my remarks at page 200, on his patent, which were provoked by the nonsense introduced into the abstract of his specification (as it now appears) by the printer. At the same time I must be permitted to observe that the matter-of-fact portion of my remarks, as to the want of novelty on the one hand, and the utter unfitness of some of the proposed ingredients on the other, are not to be got rid of so easily as Mr. Wright seems to imagine.

Whether Colonel Macerone ever did "publish, or cause to be published, any directions for a water-proof composition *at all resembling* that" patented by Mr. Wright, is a question your past volumes will answer, and one that does not rest on my veracity: it may not, perhaps, be convenient to Mr. Wright to find the passages.

Although Mr. Wright may have invented this composition in 1805, his invention can only legally date from January, 1844; and forasmuch as "the public cannot be deprived of any information they possessed at the time of sealing the patent," Colonel Macerone's *unpatented* water-proof composition cannot be interfered with by Mr. Wright's patent.

As a contributor to your useful Magazine, I trust my standing is of sufficient date to protect me from the imputation of seeking consequence by provoking idle controversy.

My object has ever been to elicit truth, and I have seldom started an objection on slender grounds, or raised a question the settlement of which was not of some public importance.

I am, Sir, yours respectfully,

Wm. Baddeley.

29, Alfred-street, Islington,
Nov. 11, 1844.

DREADFUL EXPLOSION ON BOARD OF THE "GIPSY QUEEN"—DEATH OF MR. JACOB SAMUDA, C.E., AND EIGHT OTHERS.

A deplorable event has this week deprived the engineering profession of a young member of its body, who was rising fast into eminence, and promised to be, ere long, one of its brightest ornaments. Mr. Jacob Samuda, the elder of the brothers Messrs. Jacob and Joseph Samuda, of the Southwark Iron Works, has lost his life from an explosion on board of a vessel called the *Gipsy Queen*, which his firm had just fitted with engines of a new construction, patented by them on the 10th Aug., 1843, (owing, however, as will be presently seen, to no defect in the engines themselves). Eight workmen have also shared the same fate, and three more remain in a state of great danger. The circumstances of the sad disaster, so far as yet known, will be found detailed in the following report (taken expressly for this journal) of the first day's proceedings of the Inquest Jury. The case having been adjourned till Saturday, we shall not be able to give the conclusion till next week, when we shall offer such observations upon it as may seem to be necessary. Mr. Samuda was in his 31st year. As a maker of steam-engines he was not so well known to the public as by his successful exertions, in conjunction with Mr. Samuel Clegg, sen., to introduce the atmospheric system of railway transit.

THE INQUEST.—TOWN-HALL, POPLAR.
13th November, 1844.

Before Mr. BAKER, Coroner, and a highly respectable Jury.

The names of the deceased persons, on whose bodies the inquest was held, were—Mr. Jacob Samuda, Samuel Dodd, Henry Schovell, James Schlanders, Thos. Nugent, John Newman, and Arthur M'Ghee.

JOSEPH REED, of Orchard-place, Blackwall, identified the bodies.

Mr. GEORGE LOWE examined.—Is an engineer, in the employment of the Messrs. Samuda; they are iron steam-boat builders (at Bow-Creek) as well as engineers. They constructed the engines of the *Gipsy Queen*. Should calculate a ship of her power and tonnage to be worth about 15,000*l.*; her engines, 8,000*l.* The engines are of the construction called "bell-crank," and are the subject of a patent granted to the Messrs. Samuda. They were a pair of engines moved by one shaft; the engines stand fore and aft, instead of athwart the vessel; being so placed to save room. Does not consider this arrangement more dangerous than the common one. In a common beam-engine, there is a single beam which moves on its centre; whereas, in Messrs. Samuda's, the beam is in two parts, and has its motion at the extreme end. Did not see the part which gave way (the steam-pipe communicating between the boilers and cylinders) till after the accident. Had heard that the Messrs. Samuda were under a contract to work up all the parts of an old steam-engine; and the steam-pipe which gave way appeared to have been part of the old pipes. The engines were of the sort called "condensing." The valve would not rise at 10 lbs. to the square inch, and the boiler was tested up to 40. The horse-power of the engine would depend upon the pressure; at 10 lbs. pressure, the power would be about 200 horses. The diameter of the cylinder is 45 inches. The vessel started from Blackwall, on her first experimental trip, at about three o'clock, and passed Woolwich; she then turned, and arrived at Blackwall about ten minutes past five o'clock. Witness worked one engine, and the deceased, Samuel Dodd, the other. On her stopping, witness wanted to draw the fires, but the engines were kept working until she was fastened to her moorings. The safety-valve was loaded to 26 lbs. on the square inch; but at starting the pressure did not exceed 6 lbs. to the square inch, nor did it ever exceed 10 until the vessel stopped. Considers that had the pressure not exceeded 10 lbs. to the square inch, the accident would not have happened. The pipe was connected at the ends by spigot and faucet joints. Where it appeared to have given way was about 14 or 15 feet from the centre.

By a JUROR. If the pipe had been of copper, would you have had a joint of that description?—I should.

On arriving at Blackwall, Mr. Samuda said, "That will do for the engine." Witness replied, "Then I will draw out the fires, and blow out the boilers;" which meant, that he would empty the boilers of the water. He said, "Don't do that; I want to see 25 lbs.;" meaning 25 lbs. on the square inch in the boilers. Mr. Samuda then added, "Fetch me a candle." I did so; we both of us looked at the gauge, and found it to be 10 lbs. to the square inch. He told me to go and see if the steam was blowing off. I desired one of the firemen to go, but deceased stopped him, saying, "Go yourself; I cannot depend on any one but you." I then went, but had not gone four steps from the hatchway, or companion, when the explosion took place. About an hour and a half elapsed before the bodies of the deceased persons could be got out. Cannot tell what caused the explosion.

By a JUROR. Could you, as a practical man, have placed those pieces in a manner that no explosion could take place?—Not as they were arranged. No steam could blow off without a pressure of 26 lbs. on the square inch upon the boiler, for then only the safety-valve would rise. There was some steam blowing out when witness got upon deck; so that, instead of the 10 lbs. to the square inch on the boiler, as there was when under weigh, the pressure must have exceeded 25. It was the spigot and faucet joints which gave way; the explosion had lifted the pipe out of the sockets. The parts were not bolted together, but packed by gasket and hemp, the ordinary mode of packing such joints, which are so constructed as to allow for contraction, expansion, and vibration. (It was here stated by Mr. James Pim, of Dublin, who attended the inquest as a friend of the deceased, that the spigot-pipe entered the other full six inches.) The boiler had been tried to 40 lbs. to the square inch, but by water only; had not been tried by steam, to witness's knowledge.

By the CORONER: Of what material were the steam pipes composed?—Of cast-iron. Understood that Messrs. Samuda were under contract to bring as much of the old material into use as possible, provided they were fit for the purpose. Believed that the steam pipes, the air-pumps, and cross-heads were of this old material.

By a JUROR: Are you aware of the terms of the contract?—I am not; but I should

think that the Messrs. Samuda need not have employed any part that was defective.

The CORONER. It appears to me that it was more of a giving way, or separating of the parts at the joints, than an explosion.

By a JURYMAN. You say that the part where the pipe gave way was about 14 or 15 feet from the boiler, and that with 10 lbs. to the square inch, no danger would accrue from working with a joint of that description. Is that your opinion?—Yes; the accident would not have happened had the pressure not been increased, but with the increase such a joint was not safe.

The CORONER remarked, that he was not versant in such matters, but if such were the ordinary way of making these joints, he could not see why such accidents were not of daily occurrence. He would be much obliged, therefore, if the witness, as a practical man, could point out to him and the jury how this danger might be obviated.

Mr. LOWE. The danger could have been obviated by better securing the joints (so we understood the witness to mean, though his answers on this point were rather indistinct.) The pipe as it was, was quite equal to 10 lbs. pressure, but not much more. At 24 lbs., would expect the pressure to blow out the joints. The safety valve was loaded to 25 lbs., but never got higher than 10 lbs. while the vessel was going. The accident took place after the engines had stopped, and when the pressure must have been about 25 lbs. The steam was just oozing out at the safety valve, when witness was on deck. The pipe was of cast-iron, but if it had been of copper, witness would have used the same sort of joint. Did not think the pipe too long for such a joint; had lately worked an engine with a larger steam-pipe at a pressure of 35 lbs. The safety-valve was locked up, and no person could have had access to it.

Mr. PIM, by permission of the Coroner, examined the witness, as follows:—

You state that the accident did not occur from any peculiarity in the engines?—It did not.

Nor from anything in the boiler with the construction of which you are conversant?—It did not from either of those causes.

Neither did the material of which the steam-pipe was composed at all contribute to the accident?—It did not.

Then it necessarily follows, that the only cause of accident was the mode in which that joint was made?—Yes.

Could you in any way make this joint with the same pipe capable of resisting any pressure of steam that the boilers would generate?—Not with the same pipe.

But by altering the form of the pipe, is it possible to make the joint such that it would be perfectly safe for the future?—I could make it capable of withstanding any pressure.

What depth did the spigot enter the socket? I should think about 5 or 6 inches.

Mr. PIM observed that Mr. Joseph Samuda had told him that morning that it was 6 inches.

By the CORONER. Where did you leave Mr. Samuda when you came on deck?—He was standing immediately under the joint.

The CORONER. Then it seems the engineer had placed himself at the point where the greatest danger existed, and that he was the first victim to his own imprudence.

Mr. JAMES PIM here observed, that the vessel was not the property of the Messrs. Samuda as had been stated, but of the Waterford Steam Packet Company.

The CORONER remarked that there seemed to be no question as to the solidity of the engines or the capability of the boiler. The only question for the consideration of the jury would be the *modus constructi* of the joints.

After asking, whether any person present differed from Mr. Lowe on this point, and no one answering, the Coroner then adjourned the proceedings until Saturday morning the 16th of November, in order to afford an opportunity for the production of further evidence.

THE ATMOSPHERIC MARINE STEAM-ENGINE AND THE "WONDER."

Sir,—Coachmen continue to oppose railroads and workmen machinery after every one else has acknowledged their utility; and I suppose the opposition of "a Cylinder Lid" to that description of engine which dispenses with his services, must be attributed to the same principle as he does not support it by any solid reasoning. He calls the trials of the *Wonder* undefined results, and objects to the manner in which he presumes they were made. Now, these are precisely the same objections which were before urged by "Mercator," and fully refuted by "R. W." in your last Number.

He says, that I seem to depend upon these results for the agreement of the public with my opinion, but a reference to my letters would show that my arguments in favour of atmospheric engines, were written before the *Wonder* was built; that they were as purely theoretical as the objections to those engines to refute which they were written; and that when I referred to the performances of the *Wonder*, it was merely as confirming the accurary of my former conclusions.

It would have been better if instead of merely giving it as his opinion, that my letters were unsatisfactory, "Cylinder Lid" had pointed out what part of my reasoning he considered false, and had endeavoured to refute it.

I can see no reason why he should apply to me for information, which he could only obtain from the makers of her engines; but, although, unable to give all the details which he requires, I am able to say, that should he apply to Messrs. Seaward and Capel, he will find they undertake to make atmospheric engines both lighter than marine engines of the same power of either of the descriptions which he names, and quite as economical.

I am, Sir, your obedient servant,

CURVE.

DIVERGING AND CONVERGING SERIES.

Sir,—Your correspondent, Mr. Sankey, in vol. xxxi., p. 137, deduces this equation, viz. $\frac{1}{2} = \frac{t^2}{3} - \frac{t^4}{5} + \frac{t^6}{7}$, &c., to infinity, where t is the tangent of a certain arc. He tells us, "that, by reversing the series, we find that t = tangent of an arc of 66° 52′ (this is not very exact, but it is not far from the truth). Now, the thing I would ask Mr. Sankey, is this: How is the infinite series $\frac{t^2}{3} - \frac{t^4}{5} + \frac{t^6}{7}$, &c., to be obtained by the method of reversion? I am well aware that many infinite series that follow some given laws may be found in *finite* terms by the method of reversion. But at the same time, many other such series cannot be so determined, and if I am not greatly mistaken, this infinite series $\frac{t^2}{3} - \frac{t^4}{5} + \frac{t^6}{7}$, &c., is one of that kind. The required one being 66° 52′, its tangent is greater than 2, (or more correctly $t = 2{\cdot}34069$,) so that the infinite series $\frac{t^2}{3} - \frac{t^4}{5} + \frac{t^6}{7}$, &c., converging, absolutely diverges, and such series has always been held as useless. Now, it is well known that in the infinite series $t\left(1 - \frac{t^2}{3} + \frac{t^4}{5} - \frac{t^6}{7}, \&c.,\right)$ which gives the length of the arc in terms of the tangent. Before we can sum this series, we must first assume an arc whose tangent is known. Thus, the tangent of 60° to the radius 1 is $\sqrt{3}$, and the series becomes $\sqrt{3}\left(1 - \frac{3}{3} + \frac{9}{5} - \frac{27}{7} + \&c.,\right)$ and this being a diverging series, is therefore useless. If the arc is 30° the tangent will be $\sqrt{\frac{1}{3}}$, then the length of the arc will be,

$$\sqrt{\tfrac{1}{3}}\left(1 - \frac{1}{9} + \frac{1}{45} - \frac{1}{189} + \frac{1}{729}\right);$$

and as this series converges, we can compute the length of the arc to any required degree of accuracy. But no other way has ever been discovered of summing this series to any required degree of exactness than that of computing each term of the series, and multiplying the result by $\sqrt{\frac{1}{3}}$. If we could find the exact sum of the series,

$$\sqrt{\tfrac{1}{3}}\left(1 - \frac{1}{9} + \frac{1}{45} - \frac{1}{189}, \ \&c.,\right)$$

then we should have the exact length of an arc of 30°, and so of the whole circumference; but this problem has never yet been accomplished (and never will). It is on this account I wish to know how Mr. Sankey has been able to revert the series $\frac{t^2}{3} - \frac{t^4}{5} + \frac{t^6}{7}$, &c.

I am, Sir, yours &c.,

IVER M'IVER.

November 10, 1844.

P. S. Will any of your able contributors solve the equations $x^3 + y^3 = a^3$, and $x\,y = b^2$ by quadratics, and from the said equations to analyze the celebrated rule of *Curdan* for cubic equations.

I. M.

INFLUENCE OF LIGHT AND AIR ON VITALITY—WARD'S CASES FOR REARING PLANTS IN LARGE AND SMOKY TOWNS.

[From Report of the Health of Towns' Commissioners.]

Nathaniel Bagshaw Ward, Esq., examined.

Have you directed your attention to subjects connected with the health of the humbler classes in crowded communities?—I have.

To what points have you particularly directed your attention?—The influence of light and of air, freed from deleterious particles.

What observations have you to make

upon those points? During a practice of 30 years in a densely populated neighbourhood, my attention has been repeatedly drawn to the influence of light, not only as a most efficient means of preventing disease, but likewise as tending materially to render disease milder when it occurs, and more amenable to medical and other treatment. Dupuytren (I think) relates the case of a lady whose maladies had baffled the skill of several eminent practitioners. This lady resided in a dark room (into which the sun never shone), in one of the narrow streets of Paris. After a careful examination, Dupuytren was led to refer her complaints to the absence of light, and recommended her removal to a more cheerful situation. This change was followed by the most beneficial results; all her complaints vanished. Sir James Wylie has given a remarkable instance of the influence of light. He states that the cases of disease on the dark side of an extensive barrack at St. Petersburg have been uniformly for many years in the proportion of three to one to those on the side exposed to strong light. The experiments of Dr. Edwards are conclusive. He has shown that if tadpoles are nourished with proper food, and exposed to the constantly renewed contact of water (so that their beneficial respiration may be maintained), but are entirely deprived of light, their growth continues, but their metamorphosis into the condition of air-breathing animals is arrested, and they remain in the form of large tadpoles. Dr. Edwards also observes that persons who live in caves and cellars, or in very dark and narrow streets, are apt to produce deformed children; and that men who work in mines are liable to disease and deformity beyond what the simple closeness of the air would be likely to produce.

When you speak of light, you speak of solar light?—Yes; but if solar light cannot be obtained, a large quantity of diffused light is useful.

In the course of your investigations on the influence of the temperature of airand light on the health and growth of animals and plants you were led to the discovery of a mode of rearing plants in large towns, and conveying them to and from distant places, by what are commonly called Ward's Cases?—Yes.

Are you of opinion that if plants were grown in that manner in the dwellings of the poor, they would have any beneficial effect?—I think it would be laying the axe to the root of the tree; that you would do more good to the poor by the adoption of some such plan than can be conceived; that by the introduction of those plants, you would induce the poor to get out into the woods round London, instead of going to the public-houses; and that it would be an occupation of the most interesting nature to the women and the children.

What would be the expense of one of the cases referred to?—The expense would be trifling; glazed and puttied frames can be obtained at a shilling the square foot, which might be put in their windows and little yards, and they would repay the expense of the case within a twelvemonth by the growth of salad or flowers. These cases are becoming more common, and furnish the most delightful blinds which can be imagined.

Have you reason to think that they have a direct influence in diminishing the quantity of carbon or deleterious ingredient?—There cannot be a doubt of it; the concurrent testimony of all naturalists, proves that the vegetable respiration counterbalances animal respiration by purifying the air which animals vitiate.

In many cases where ordinary drainage could not be effected, you would secure a similar effect by the introduction of vegetation?—Yes.

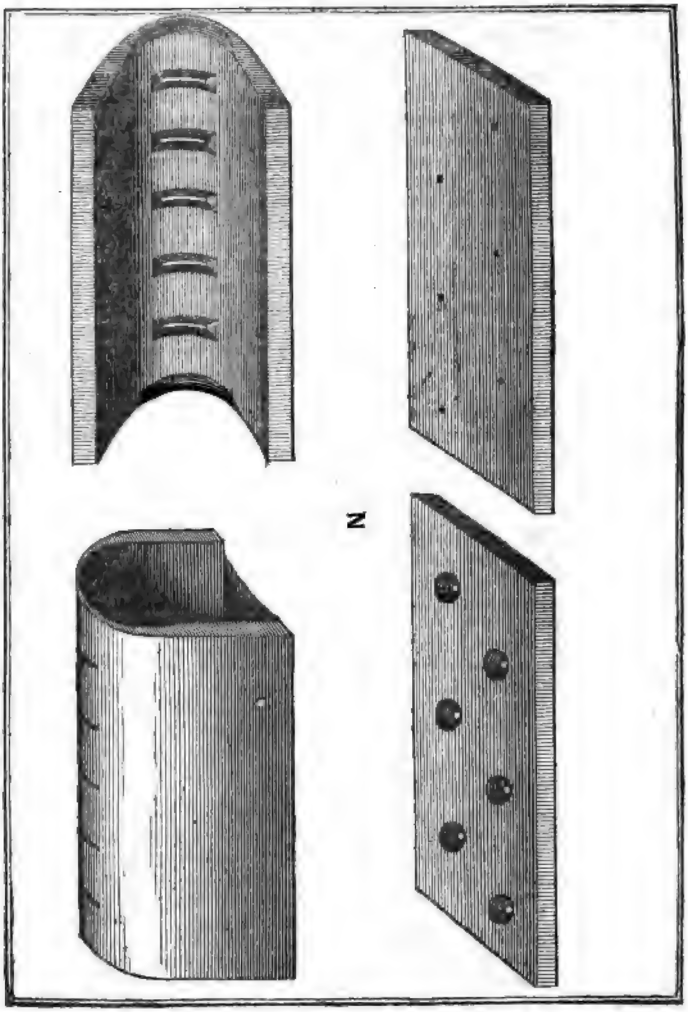
Do you think that if plants could be introduced, they would have that effect?—I think the effect would be in proportion to the amount of vegetation; the most putrid ditches and ponds will be purified by plants growing in them, and the water is preserved in a state fit for animals to drink.

Do you think there are any plants which can be kept in a room where persons are living which are injurious?—There are some plants whose odours may be injurious to certain individuals; but, generally speaking, plants have noother effect than that of purifying the air.

Are there any particular plants, in the dense and not very good atmosphere of London, which are more easily kept in those small cases, which would be suitable for the poor?—By means of these cases you can command, in the most smoky parts of London, a most luxurious vegetation, and in proportion to the solar light and heat you may get flowering plants, and plants with greater colour, and so on; but there is light enough in the most dirty parts of London to grow plants of the most delicate kind; as, for instance, the Irish fern, the Trichomanes speciosum. This is a plant which has hitherto baffled all attempts at cultivation, and which if placed in a glazed case, will now grow in any blacksmith's shop in London.

Your cases are not absolutely air-tight?—The law regulating the diffusion of gases would render such a state of things impossible. The cases are only made sufficiently close to retain the moisture and exclude all deleterious particles.

WATSON'S PATENT DRAIN TILE.



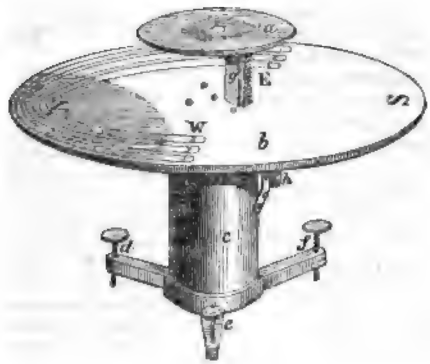
When common drain tiles are used, the apertures which admit the water are only such as are accidentally formed from the circumstance of the tiles not fitting closely together; and when these apertures become clogged (which often occurs), there can be but little water drained off.

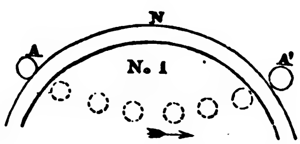
Mr. Watson's improved tiles have several apertures left in them which enlarge *inwards*, so that they cannot become clogged as other apertures do; these tiles must therefore be much more efficient than those hitherto used.

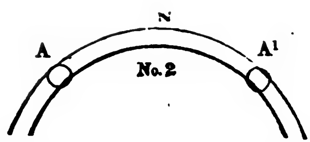
The patent tiles are made by hand, and in the ordinary way, except that a little additional care is required in finishing the apertures; and this is such a trifling addition, that at the tile-kiln of Mr. Rhodes, in Hackney-road, they are sold at the increased price of only 5*s*. per thousand for three-inch arched tiles.

THE ORTHOCHRONOGRAPH.

[Registered under the Act for the Protection of Articles of Utility.]







The inaccuracy and irregularity of almost all our public clocks have long been the subject of well-founded complaint; but now that the value of time is every day becoming better appreciated, and punctuality (thanks to the example of Royalty) a more prevailing virtue, it is more than ever necessary that correct time should be kept in every town throughout the kingdom. Many instruments have been devised at different periods for the purpose of ascertaining correct time by an observation of the sun; but of these the greater number are not sufficiently accurate, while others, besides being very expensive, require to be immovably fixed, and adjusted with the utmost precision, and then only give results which must be subjected to such complex calculations, that it is impossible they can ever become popular, or be brought into general use.

At the late meeting of the British Association, Dr. Robinson exhibited and explained the Orthochronograph, an ingenious instrument recently introduced by Messrs. Webster and Son, the eminent chronometer manufacturers, of Cornhill, London. The Orthochronograph effectually accomplishes the object in view, the ascertaining of correct time, and is exempt from the foregoing objections. Its property is derived from the intersection of a curvilinear line at two points by the circular transit of a solar ray. The instrument consists of two horizontal circular plates, parallel to each other. The upper one, *a*, has an aperture for the passage of a solar ray; the lower one, *b*, has three pair of semicircular lines, for the purpose of making observations. The lower plate, *b*, is supported by a pillar, *c*, resting on a tripod, furnished with three adjusting screws, *d e f*. The upper plate *a* is raised or lowered by means of a rack *g*, working out of the pillar *c*, by means of a pinion and friction rollers, acted upon by the milled head *h*.

For taking an observation, place the instrument upon any firm support, with the letters N and S as nearly north and south as may be; but rigid accuracy in this respect is by no means essential. By means of a spirit level, and the adjusting screws *d e f*, bring the plate *b* into a horizontal position; then raise or lower the plate *a*, until the sun's ray is in contact with the line on which it is intended to make the observation, as at A in the diagram, No. 1, or until the ray appears within the double line as at A, No. 2. In either case note the hour, minute, and second, when the ray is at A; leaving the instrument undisturbed

the sun's ray will traverse the plate in the direction of the arrow until it arrives at the point A′, when the time is again to be accurately noted. Add the results of the two observations together, and divide by 2; the difference between this result and 12 hours will show the error of the clock as compared with solar time, which being corrected by the necessary equations (of which very complete tables are given in the descriptive pamphlet which accompanies the instrument) gives the desired result. For example, an observation is taken outside the line, (No. 1,) on the 21st December, 1843.

	h.	m.	s.	
1st Observation A,	8	58	15	
2nd ditto A′,	14	52	24*	
	2)23	50	39	
	11	55	19	
	12	0	0	
	0	4	41	too slow.
Equation of time,	0	1	51	slow.
Clock really too slow,	0	2	50	

The interval between the two observations will depend on the time when the first is made; it is better not to be less than three hours; the first observation, therefore, should not be later than ½ past 10 a.m.

The Orthochronograph is at once cheap, portable, and simple in its construction and use, not liable to be deranged, and may be used in any part of the world by the most unpractised hand; while the result of the observation requires only the operation of addition or subtraction to give true time.

To country clergymen, watchmakers, and persons having the care of public clocks, such an instrument is almost indispensable; to the lover of mechanics or the mathematician it will afford the pleasure which always arises from a new application of natural phenomena to practical purposes; while the mariner will find it serviceable, when, on making the land, he wishes to test the accuracy or his chronometer.

W. B.

* The hours after noon are reckoned as 13, 14, 15, &c., and not as 1, 2, 3 o'clock, &c.

WATER WORKS—ECONOMY AND ADVANTAGE OF A CONSTANT SUPPLY AT HIGH PRESSURE TO THE HOUSES OF BOTH RICH AND POOR.

[From the Report of the Commissioners of Inquiry into the State of Large Towns and Populous Districts.]

Thomas Hawksley, Esq., C.E., Nottingham, examined.—As an engineer, have you given much attention to the modes of supplying towns with water, and have you, besides superintending the construction of some works, had under your direction the greater part of the supply of water to the town of Nottingham?—I designed and constructed the Trent Waterworks at Nottingham in the year 1830-31, and am resident engineer at this time. I have also been employed by several other companies.

What is the number of houses to which water is supplied from the works which you superintend at Nottingham?—About 8000, containing a population of about 35,000 persons.

What is the greatest pressure at which water is kept upon the pipes supplied?—The greatest pressure is about 120 feet, and that on a considerable portion of the town. The average pressure may be stated to be about 80 feet, there being in Nottingham great variations of altitude.

Is the high pressure kept upon all classes of pipes and at all times?—Yes, upon all classes of pipes; the principal main, the district main, the street service pipes, and the tenants' communication pipes.

By the term tenants' communication pipes, do you mean the smaller lead pipes which are within the houses, and that upon these there is the common and constant high pressure night and day?—Yes. We have no use for the term high pressure. It is the ordinary state of the water within the pipes. The pipes are charged so as to deliver water to the tops of all the houses which are within a proper distance beneath the head of water in the superior reservoir. High service is the term used by companies who supply water to a certain height, say to the first floor; and who levy an additional sum from parties for whom they force (by the higher service or pressure) the water up to more elevated stories.

Does the high service occasion much additional expense?—The extra cost of pumping to raise the water to the highest points for which it is ordinarily required is very slight. There is but one pressure at Nottingham, and that is the same at all times, and is found to be economical. If the water were lifted only half the height the saving would not amount to more than about $\frac{1}{20}$th of the total charge.

Then with the tenants' service pipes full at

all times, and in constant communication with the mains and chief reservoir, you dispense with the necessity of the tenants having water-tanks?—Entirely. All the houses that have been supplied since the Trent Water Company has been established, which are very numerous (indeed, probably amounting to 5000, or more, out of 8000) are without water-butts. In the houses taken by the Trent Company from the former company, the tenants of which became tenants of the Trent Water Company, there were brick cisterns under the floors already existing; of course we only attached the old communication pipes to the service pipes of the new company, and so far as the majority of those tenants are concerned we do supply the tanks, for they existed before; but even in many of those cases the tanks have been abandoned, and the tenants take their water in the same way as others.

It is stated that under the common arrangement of having water "on" for such a time on alternate days as may fill butts and tanks, that of the total capital invested in the complete machinery, the portion of the tenants' outlay, consisting of the house butts or tanks, ball-cocks and pipes, involves the expenditure of a capital equal to that invested by the company; for example, if the company's capital amount to 50,000*l.* for engines, mains, &c., the tenants' capital invested for tanks, ball-cocks, and pipes will involve an equal expenditure, and that half perhaps of the tenants' portion will consist of the expense of the tank, butt, and ball-cock?—The expense of the tank or butt will in general be more than half the tenant's expense, considered exclusively of the cost of the communication pipe used in the street, which is at Nottingham provided and maintained by the company, but probably not otherwise.

Is the branch pipe which goes to the tenement in each case included in the company's capital in the calculation you speak of?—It is provided by the landlord in most towns. In some towns it is not provided by the landlord. At Nottingham it is a work done at the expense of the company; the company takes on itself the whole of the pipes which are laid in the public highways. With that portion of the pipe which extends within private property the company have nothing to do. Under their Act of Incorporation I think they could not legally expend their capital in extending pipes on private property.

In the capital of a company, do you include the pipe to each of the individual houses?—I should say not. In general that would be the tenant's charge; but in the case of Nottingham it constitutes only a small portion of the expense of works, it costs the company about a shilling a foot on the average, including taking up the street, putting down the pipe, and enclosing it, and may amount to between 2000*l.* and 3000*l.* The cost of each of the company's branches may possibly average 15*s.*, but as one branch will in the majority of instances supply a whole court, the cost per tenement supplied will not exceed 6*s.* or 7*s.*

It is a complaint in respect to the poorer districts where the population are actively occupied that the cleansing and proper care of their receptacles for water, or butts, is greatly neglected, and that they become sources of impurity; they are not properly covered; that soot and dust get in; that in summer time they are frequently exposed greatly to the action of the sun, and the wooden butts are apt to decay. All labour of cleansing these causes of impurity is prevented by the arrangement of keeping the pipes constantly full?—Yes; it may be said that the effect of this arrangement is to substitute one large reservoir or tank well situated and under effectual care, for the many thousand ill placed butts and tanks requisite to afford a copious supply on the common arrangement.

Are there not other conveniences and economies attendant on such an arrangement as that in practical operation under your charge at Nottingham, and stated to be in operation in some other towns?—Yes; there is the saving of the room occupied by the tank, which is in some districts of much importance; there is the avoidance of the damp from the evaporation of a body of water in the house, the saving of accidents and of leakage, and of the inconvenience from having the tank sometimes empty. In many houses where there is no convenience for a tank in the upper part of the house it is placed in a lower apartment, and the water must be borne up stairs for use; the labour incurred necessarily restricts the free employment of the water for many purposes to which it might be beneficially and healthfully employed. In such places, too, the expense of a force-pump to charge tanks for water-closets, and of waste and warning-pipes, is sometimes necessary. This apparatus for the middle and higher class houses is not only very expensive but liable to be often out of repair, constantly bringing the plumber into the house. Another and a very serious inconvenience affecting the habits and sanatory condition of the population attendant on the system of partial or occasional supply is, that it creates an inconvenience and an obstacle to the use of baths. With a constant supply of water at sufficient pressure baths might be supplied in private

houses with little difficulty or expense, so little, indeed, that I believe it to be practicable, and hope yet to see baths introduced into the houses of labouring men for the use of themselves and families.

As an abatement to the economy from dispensing with the use of the water-butt and tank and its machinery, must not the tenants' communication pipes be much stronger and more expensive to bear the constant pressure?—If anything, there may be a *saving* in the tenants' outlay for pipes. These pipes in the metropolis and other places, where the companies' supply is only occasional, are larger than necessary that the water may be delivered within a short time. In towns the usual size of the tenants' pipes is three-quarters of an inch, and in the larger houses one inch; whereas with the constant supply, half-inch pipes will serve the same purpose. If necessary we can have stronger pipes of the same weight. Pipes of half-inch diameter and two-and-three-quarter pounds weight per foot are found to be secure at the strongest pressure employed in Nottingham.

In some evidence given on this subject by Mr. Wicksteed, the engineer of the East London Water Company, he states, that "if such a plan (*i. e.* of having the tenants' communication-pipes constantly full to the highest parts of the town) were to be adopted in a city so large as Cork is, the sizes of the mains must be very large, and the waste of water would be excessive." He afterwards illustrates this opinion by the following hypothesis:—

"Suppose a supply of water to be required for 20,000 houses, and the height to which it was raised at the works was such that a 20-inch main would be sufficient to give the supply according to the system herein-before explained, it would not be so if the water were constantly on in all the pipes, both mains and services; for example, suppose the size of the lead pipes to supply the houses to be upon an average half an inch in diameter, then the aggregate areas of 20,000 half-inch pipes would be equal to 27¼ square feet, and it would require a main of 71 inches diameter at the source to supply the town, instead of 20 inches, and for side streets, containing 100 houses each, it would require pipes of 5 inches diameter instead of 3 or 4 inches. This is an extreme case, but one that it would be necessary to provide against; because if the water is always on, the houses may be all at one time supplied; and even trusting to the chances of only one half the number of houses taking water at the same time, the main must then be 48 inches in diameter at the source. In addition to the necessity for this extraordinary outlay, in the first instance, the quantity of water that would be used would be enormous, and consequently the expense of raising a sufficient supply would be increased in proportion, and the object sought, that of having a strong pressure of water in the mains, would be defeated by the very means proposed to ensure it, for inasmuch as the water in the pipes would be always on, so would the draft by the houses be constant, and the present power of shutting off the supply from the side streets, and applying the full force of the supply to the particular locality requiring it, would be destroyed." Again, the opinions following are stated in the answer to the several questions put:—

"Q. Are you aware that at Philadelphia this is the practice; that every day the hose is screwed to the main or pipe in front of the house, and the pavement washed with it; and that once a week, or at certain times, it is the custom of the inhabitants to wash the whole front of the house up to the highest windows, and that upon the occasion of fire the hose is attached, and applied immediately, and that that arrangement is ready at all times, night and day?—*A.* I am not aware of that fact. *Q.* And that at New York it is proposed, by similar arrangements to those at Philadelphia, to supersede fire-engines entirely?—*A.* Then they must have an elevated reservoir, or the machinery must be kept at work constantly. *Q.* One gentleman, Mr. Thom, of Greenock, has stated to the Commissioners—In every case where the distributary basin can be placed high enough, pipes in the street ought to be kept constantly full, so as to be always ready at a moment's notice to extinguish fires; and the distributary basin should be placed high enough to send the water over the tops of the highest houses, by merely putting the hose of a fire-engine on one of the fire-plugs, which should be attached to the pipes at short distances through all the streets. This I have done at Greenock, Paisley, and wherever I gave the plans. The advantage is immense; and were it properly and generally practised, there would be little need for insurances from fire. Have you seen any of those instances, and are you aware of any reasons why the same arrangements by artificial reservoirs may not be generally applied to a town?—*A.* I agree generally with what Mr. Thom has said, with this difference, that in a large town you could not serve the whole of the pipes. If he means the mains, then I should agree with him entirely. The mains ought always to be charged, especially when you have an opportunity of getting an elevated reservoir. *Q.* Taking a large town as an aggregate of several towns, may you not do

for a large town what is actually done for several provincial towns?—*A.* The objection is this, that if your water is always on, you would have to supply a much larger quantity of water than is now necessary to give an abundant supply, and you must have a great many extra officers to prevent improper use of the water. If you can insist upon every inhabitant having a ball-cock, and if you can be satisfied that there would be no unnecessary waste, and no unfair dealing in the houses, then the objection to having all the pipes charged is removed. But if you cannot do that, you are very likely, at the time when you have a fire, instead of having the water concentrated at the place where you want it, to find the water drawn off in different parts of the town."

Now what does your observation of the actual fact and experience enable you to state to be the case as to these several hypothetical or scientific deductions, and first as to the actual waste of water; what is that at your works?—A judgment may perhaps be best formed as to the small extent of waste from a statement of the actual amount of supply. The actual amount of supply at Nottingham is not more than from 80 to 90 gallons per house per diem; this is taken by about 8000 tenements and works of every description, amongst which are breweries, dye-works, steam-engines, and inns, and other places of large consumption.

Does the system of constant supply equalize comparatively the rate of delivery?—It diminishes the rate of delivery in the service-pipes and sub-mains very materially, distributing over a greater number of hours the quantity of water which otherwise must be delivered in a very short period. The word "equalize" does not apply, because the current of water in the great leading main is but little affected.

It is spreading the supply over the twelve hours of the day?—Yes, and with the advantage that as the water travels more slowly through the pipes, smaller pipes will be equivalent to larger.

Is what is usually called the "waste of water" prevented in your works by an extra number of men?—The fact is directly the reverse. The constant supply is the means of a large economy of men. Our company has maintained its supply by night and by day ever since its establishment, except during a period of one month, when for the purpose of experiment the water was shut off at ten in the evening, and turned on again at five in the morning. It was then found that it would be more expensive to keep extra turncocks, do extra repairs to valves, draw plugs to cleanse the pipes, and attend to complaints. The original plan was therefore resumed. We find that one experienced man, and one boy of about eighteen years of age are, on the system of constant supply, quite sufficient to manage the distribution of the supply to about 8000 tenements, and keep all the works of distribution in perfect repair, including cocks, main pipes, service pipes, and the tenants' communication-pipes, to the extent they are laid under the public highways. The Old Company has adopted the system of the Trent Water Company, and now maintains a constant supply. Any company that possesses an ample quantity of water at its works, and a sufficient reservoir in an elevated situation, may adopt this mode of supply without difficulty or disadvantage, and indeed the difficulty and disadvantage is far from insuperable when an elevated reservoir cannot be obtained.

The term waste would imply an excessive expense for the pumping of water. Now it appears, from one instance, cited by Mr. Wicksteed, of the duty of a steam-engine of good construction, that this one single pumping engine, upon the expansive principle, and with coals costing 12*s.* per ton, with labour and stores, and all except the interest on fixed capital, the cost of raising 80,000 gallons of water 100 feet high was 1*s.*; that by another, Taylor's Cornish engine, 1 lb. of coal converted into steam raises 10,000 gallons of water 10 feet high: in other words, if a room 20 feet square were filled 4 feet deep with water, 1 lb. of coal converted into steam would overcome the friction of the engine, and raise that water into a room 10 feet above it. Does your own experience justify the conclusions from such intsances, that when the machinery and distributing pipes are fixed, and there is an unlimited supply of water, as from a river, the expense of pumping additional quantities is inconsiderable as an element of calculation?—Assuming the possibility of varying our works without cost, the experience at Nottingham is to this effect, that we could give 8 or 10 times the present unlimited supply for about a double charge; that we could raise all the water now taken 50 feet higher by increasing the charge 5 or 6 per cent., and that were we to lower the head to half its present height, the saving of expense would not exceed 6 or 7 per cent. on the gross charge to the tenant. The answer may be otherwise given thus: The Trent Water Company supply houses at an annual average charge of about 7*s.* 6*d.*, at any level required, even into the attics of four or five story buildings; if the supply were afforded to the level of the pavement only, the charge could not be reduced more than 6*d.* per house, or for the labourers' tenement not more than 4*d.*

It is stated that the daily supply of the metropolis is equal to a lake of 50 acres of a

mean depth of three feet,—what, on Mr. Wicksteed's estimate, would be the additional expense incurred if the supply were doubled and the additional quantity were raised by pumping 150 feet high?—On Mr. Wicksteed's experience the expense would be 25*l.* 10*s.* per diem, or 9,300*l.* per annum, which, as about 200,000 houses are supplied by the Companies, when divided gives 11*d.* per house per annum for the expense of the pumping to a height of 100 feet, or 16½*d.* of pumping to a height of 150 feet. I wish it, however, to be understood, that I do not concur in Mr. Wicksteed's mode of estimating the cost. It is quite true that the expense of pumping forms, in nearly all cases, but a small portion of the total charge to the tenant; but Mr. Wicksteed's statement would afford a result fallaciously low. Mr. Wicksteed's engine uses less coal, but employs more capital, so that the saving is rather apparent than real. And again, the London and many other Companies would be unable to obtain a supply of fuel at the price assigned by Mr. Wicksteed.

In respect to the apprehension expressed, that if the system of constant supply at high pressure were adopted much larger mains would be required, what is the evidence of fact and experience?—Directly the reverse of the hypothesis. If the supply of water for ordinary purposes be the only consideration, then, for the same reason that smaller pipes do suffice for the tenants' communication pipes, smaller mains will suffice for the system of constant supply at high pressure. Where 20-inch mains are used on the system of periodical supply, 12-inch mains would amply suffice for the system of constant supply; instead of the 7 and 6-inch mains, 5 or 4-inch would suffice; instead of 3-inch service-pipes for the occasional supply, 2-inch would suffice for the constant supply; indeed, for constant conveyance, sizes much smaller than these would answer the purpose; but as there are irregularities of draught, it is needful to provide accordingly. The objection of Mr. Wicksteed is founded upon a supposed state of things which never does occur, namely, of all the pipes discharging water at the same time.

An objection to the introduction of water into the houses of the poorest classes is thus stated by Mr. Wicksteed:—"Where a landlord has got 20 or 30, or 40 or 50 houses, and requires a supply of water, if they are poor houses, it is frequently given by one common stand-cock to all the houses. If he was to put a separate supply to those houses by a lead-pipe, the lead-pipe would be there in the evening but would be gone in the morning." Now, do you find that tenants are apt, for the sake of the lead, to cut off their own supplies of water; and what, under all circumstances, is your experience on the point?—We have some of the poorest and worst-conditioned people in Nottingham, and we scarcely ever experience anything of the kind. In fact, the water at high pressure serves as a police on the pipe. The cutting off a cock with the water at high pressure is rather a difficult matter to do quietly: "knocking up" is too noisy; and when a knife is put into such a pipe, and a slit is made, a sharp, flat, wide stream issues, very inconvenient to the operator; and when the pipe is divided there is the full rush of the jet to denounce the thief. We have lead-pipes all over the town in the most exposed places, and I can affirm that such an event rarely occurs *out* of the houses, and never *within*.

At what charge is water given into the houses of the labouring classes on the system of constant supply and high pressure at Nottingham?—For a two or three story-house of three rooms, the charge being on the rental, it comes to about 1*d.* per week. For this sum the tenants have any quantity of water they choose to take.

The two and three-story houses are inhabited by the labouring classes, are they not?—They are.

How many of them are supplied in Nottingham at this rate of 1*d.* per week?—Rather more than 5000 supplied by the Trent Waterworks Company have been charged by owners 1*d.* per week in the shape of additional rent.

And this 1*d.* a-week gives the Company its fair interest and remuneration?—The Company's rates vary according to the sizes of the houses, or rather according to the rents charged for them. The annual sum taken in respect of the supply of water to these 5000 houses affords an average of 4*s.* 7½*d.* each.

You give this supply of filtered water (in round numbers) at 1*d.* per week: you having only two-thirds the supply of the town on which to charge the expense of your whole fixed capital, and being able, if you had the supply of the whole town, to pump water for the whole at an addition of not more than one-twentieth to your annual expenses of management?—Yes; but that is the additional expense of pumping only. We should have some additional charges to pay, but those charges would be considerably less than in the proportion of the additional business done.

What has been the effect produced on their habits by the introduction of water into the houses of the labouring classes?—At Nottingham, the increase of personal cleanliness was at first very marked indeed; it was obvious in the streets. The medical men reported that the increase of cleanliness

was very great in the houses, and that there was less disease. There was, also, an advantage in the removal of the assemblages round the public pumps. At Newcastle-on-Tyne, where they have common fountains, and where young girls are brought into contact with every description of characters, the effect is highly objectionable.

When, on the return home of the labourers' family, old or young, tired perhaps with the day's labour, the water has to be fetched from a distance out of doors, in cold or in wet, in frost or in snow, is it not well known to those acquainted with the labourers' habits that the use of clean water, and the advantage of washing and cleanliness, will be foregone to avoid the annoyance of having to fetch the water?—Yes; that is a general and notorious fact. When the distance to be traversed is comparatively trifling, it still operates against the free use of water.

DR. URE'S SUPPLEMENT TO HIS DICTIONARY.*

The great progress which our Arts and Manufactures have made within the few years since the publication of Dr. Ure's Dictionary—at once the ablest and the most popular work of the kind which ever was written—has furnished ample materials for the present most acceptable addition to it; and we are happy to say that the author has made the best possible use of them. The practice of every branch of industry treated of is brought down to its latest existing state; the improvements introduced are clearly stated, and the value of them estimated with discrimination and sagacity. Much of the information is entirely new—to scientific literature at least; being either the result of investigations in which Dr. Ure has himself been professionally engaged, (as an analytical chemist,) or derived from private sources to which he has had exclusive access. The author has frequent occasion to touch on persons as well as things, and here he sustains well the character which he has long since acquired, of being one of the most sharp and pungent of scientific writers. Sometimes, we must own, his pungency smacks a little overmuch of bitterness; but we are not sure that it is on that account the less agreeable—to the reader. Not a few individuals—some of them, too, of no small repute in the world—will be offended with the freedom and severity of his remarks; but the public at large must feel indebted to him, for the courage with which he everywhere exposes misconduct and abuse, regardless alike of personal resentments, and of the frowns of cliques and coteries.

One of the earliest articles, "BREAD," introduces the reader to some valuable details respecting the modes of baking followed in France. Dr. Ure is of opinion that the popular belief in habitual and extensive adulterations in our own country is but too well founded. His remedy for this evil is a Board of Superintendence.

"The perusal of the article BREAD will prompt the wish that our landholding legislators would consent to let the people under their domination get, at a moderate cost, some of the wheat of southern Europe, much richer than that of our average home growth in the azotized glutinous principle, so essential to the formation of our blood and muscles; a wheat adapted to make a superior bread, such as that called *pain du gruau*, in Paris, and also a superior macaroni, like the Neapolitan. In this department of industry, so important for the welfare of the population, the French have set us the example of applying to it the economical resources of the factory system, having organised a self-acting bakery, in which bread of the finest quality is made on the great scale, in smokeless ovens of a nicely regulated temperature. Meanwhile, the mass of her Majesty's subjects are dependent for their bread upon a multitude of tradesmen of slender means, who earn a scanty livelihood by hard labour, and who work up a weak inferior flour into a bad bread, which they are too often tempted to whiten with alum and other unwholesome drugs. The penalty liable to be inflicted upon bakers for having alum on their premises, is commonly evaded by letting it be added to the flour in the mill. Why do not our wise legislators enact a law for the summary conviction and punishment of a baker selling bread with alum in it; a saline compound most easily detected by chemical analysis?

"I was lately called upon professionally to examine the very white bread of a fashionable baker of high pretensions, and found it to contain a notable quantity of alum; so

* Recent Improvements in Arts, Manufactures, and Mines; being a Supplement to his Dictionary. By Andrew Ure, M.D., F.R.S., M.G.S., &c. 1844.

much so, as to have been directly offensive to the stomachs, and hurtful to the health of several individuals in the family using it. This is no solitary case, but is, I believe, that of a large proportion of the bakers in London and suburbs, who operate upon a partially damaged flour, as one may easily surmise from the disagreeable odour exhaled from the hot loaves in too many of their shops. Yet what individual will be Quixotic enough to attack the numerous and ever-changing arms of this Briareus? Who would choose to incur the trouble, responsibility, and expense of prosecuting a frequent misdemeanour of this kind, relatively to which the want of fine wheat in the market is a principal motive and apology.

"From these evils our grandees are exempt, as they bake their bread at home of the best materials. Though they are apparently regardless of the injury suffered by the public from this source, they are, however, quite alert in the execution of the game and excise laws, the stringent penalties of which are inexorably inflicted against petty transgressors, exposed to temptations often too strong for the infirmity of human nature to resist.

"In every well-governed state of continental Europe there exists a Board of Health, or *Conseil de Salubrité*, composed of eminent physicians, chemists, and engineers, appointed to watch over whatever may affect injuriously the public health and comfort. In France, this commission consists, for the capital, of seven members, who have the surveillance, in this respect, of markets, factories, places of public amusement, bakeries, shambles, secret medicines, &c. This tribunal has discharged its functions to the entire satisfaction of their fellow citizens, as appears from the following authentic report :—'Non seulement une foule de causes d'insalubrité disparurent, mais beaucoup de moyens, de procédés nouveaux furent proposés pour assainir les Arts et les Métiers, qui jusque là avaient paru inséparables de ces causes d'insalubrité; la plûpart de ces moyens eurent un plein succès. Il n'y a pas d'exemple que les membres du Conseil appelés à donner leur avis sur des plaintes formées contre des fabriques, aient jamais répondu qu'il fallait les supprimer sans avoir cherché eux-mêmes à aplanir les difficultés, que présentait aux fabricants, l'assainissement de leur art, et presque toujours ils sont parvenu à resoudre le problème. Le Conseil de Salubrité, que l'on ne saurait trop signaler, à la reconnaissance de publique, est une institution que les nations étrangères admirent, et s'efforceront d'imiter sans doute.'*

"From this confident hope of emulation by other nations, the author of these excellent observations would have excepted the United Kingdom, had he known how little paternal care is felt by the government for the general interests of the people. In Germany, indeed, where the *fatherland* feeling is strong in the breasts even of those rulers whom we are apt to consider despots, similar boards of health are universally established, whereas our legislative oligarchy frames laws chiefly for the benefit of its own class and dependents; as happened in the old time, when there was no king in Israel to regard alike the interests of the poor and the rich.

"The Prussian municipal law (*Allgemeine Landrecht*) contains the following enactments with regard to the sale of spoiled or adulterated victuals. Th. II. Tit. 20; Abschnitt 11; § § 723 to 725. 'No person shall knowingly sell or communicate to other persons for their use, articles of food or drink which possess properties prejudicial to health, under a penalty of fine or bodily punishment. Whosoever adulterates any such victuals in any manner prejudicial to health, or mixes them with unwholesome materials, especially by adding any preparation of lead to liquors, shall, according to the circumstances of the case, and the degree of danger to health, be liable to imprisonment in a correction-house, or in a fortress during a period varying from one to three years. Besides this punishment, those who are found guilty of knowingly selling victuals which are damaged or spoiled (*verdorbener*), or mixed with deleterious additions, shall be rendered incapable for ever of carrying on the same branch of business. The articles in question shall be destroyed, if incorrigibly bad, but if otherwise, they are to be improved as far as possible at the cost of the culprit, and then confiscated for the benefit of the poor. Further, whosoever mixes victuals or other goods with foreign materials, for the purpose of increasing their weight or bulk, or their seeming good qualities, in a deceitful manner, shall be punished as a swindler.'

"It is singular how, amid the law-making mania which has actuated our senators for many sessions, that not even one bill has been framed for the protection of the people from spoiled and adulterated foods and drinks."

It is deserving of remark, however, that though Dr. Ure here advocates the policy of subjecting the private operations of trade to a system of public surveillance, he elsewhere furnishes many cogent reasons for doubting the perfect efficacy of any system which could be adopted, and some too for

* "Dictionnaire Technologique," tom. ii. p. 293.

apprehending that it might often be the means of inflicting great injustice and hardship on individuals. Take, for example, what Dr. Ure himself says in his evidence before the Tobacco Trade Committee, respecting an excise prosecution for the adulteration of PEPPER:

"About a year ago the excise officers entered the premises of Messrs. Mayor and Dove, the large spice-merchants, in Little Distaff-lane, and seized a quantity of ground white pepper, alleging it to be adulterated, and carried it off: at the end of many months' disputation, the excise commissioners were pleased to allow Messrs. Mayor and Dove to get a sample of the seized pepper, which they caused to be examined by Mr. Warrington, chemical operator, at Apothecaries' Hall, and he gave a certificate after examination, stating that the pepper was not adulterated, but was genuine. The Commissioners of Excise paid no attention to that certificate, stating in reply that they had had the pepper examined by two chemists, and that they were sure it was adulterated. After six months' more disputation the matter was brought to trial before the Court of Excise in Broad-street; that was two or three weeks ago; a few days before the trial a sample of the pepper was brought to me by the solicitor of Messrs. Mayor and Dove, with a request that I would analyze it. I made an analysis, carefully investigating the quantity of essence which the seized pepper contained. Pepper contains a pungent essence, which resides in a resin; the flavour resides in a volatile oil; besides which there is a peculiar principle called 'piperine.' Pepper also contains about 60 per cent. of starch and ligneous fibre. After having analyzed the seized sample, I then analyzed, in the same way, genuine white pepper-corns ground by myself, and I obtained exactly the same result from it as I had done from the sample of seized pepper. The genuine pepper-corn gave the same dark blue tinge with iodine, which was owing to the presence of a large quantity of starch naturally in the pepper. I attended the Court of Excise. Professor Graham and Mr. George Phillips, the two witnesses as to the adulteration on the part of the Excise, were first examined; and they SWORE *that the seized pepper contained sago to the amount of* 10 *or* 12 *per cent.*, and they produced a few particles like sago in a very small pill-box, and asserted that these proved it to be sago, not only by experiments, but also by the action of iodine upon it, producing a deeper blue than with genuine pepper. I was examined; I stated the experiments I had made, and the conclusion at which I had arrived, and I showed that the colour with iodine *was produced with equal intensity upon the genuine pepper-corn as upon the seized sample.* The Commissioners of Excise, three of whom sat in judgment, after deliberating a little while, were so much satisfied with the evidence given for the defendants, that they allowed the verdict to go in their favour. I was not aware when I went before the court that the allegation against the pepper was that it contained sago. As soon as I went home I examined a sample of sago, which I had in the house, by the microscope, and I found its structure to be very singular. Sago is pearled by heating in iron pans sago starch, in a damp state, and stirring it about, when it is warm and drying, by which means it undergoes the process of pearling, forming those minute little particles which are well known to constitute the structure of sago; each of those, viewed by the microscope, appears like a ball of snow studded round with brilliant spangles of diamonds, of a most peculiar and beautiful aspect; but when the particles of ground pepper, such as were exhibited by Mr. Phillips, are put under the microscope, they have the appearance merely of amorphous particles of grey brown clay, of an appearance as different as it is possible to be imagined. Upon that I immediately wrote a letter to the Commissioners of Excise, stating that I had ascertained by undoubted proof that there was not a particle of sago in the seized pepper, and that I was ready, if they signified a wish, to wait upon them, and prove to them that there was not a single particle. In reply to that letter they wrote me a few days after, saying, that they had received my letter offering the demonstration, but as the case was finally decided, they would not put me to the trouble."

Dr. Ure was afterwards asked by the Committee this question, "If according to your judgment it would be exceedingly difficult for a practised chemist like yourself to detect adulteration, do you think it would be possible for an ordinary excise officer to make a detection of such articles?" And his answer was, "*utterly impossible.*" The point was pushed still farther by another question, "From the advance of chemical science, supposing the excise office to have *your assistance*, or the evidence of *other experienced chemists*, do you think that with all that assistance, they could detect an adulteration that might with perfect facility be introduced by chemists?" Dr. Ure answers, "I would say that adulteration may

be made upon tobacco *which may defy all the chemists in Europe to find out.*"

True, it is of pepper and tobacco Dr. Ure here speaks, but adulteration of these articles is not, we fancy, a whit more easy, or more difficult to detect, than adulteration of bread. Neither does there seem any reason to expect that if the supervision of our mills and bakehouses were to be entrusted to "experienced chemists," instead of such persons as our "ordinary excise officers," these "experienced" gentlemen would evince more tenderness of conscience where millers and bakers are concerned, than they are in the admitted habit of showing where the fate of a tobacconist or grocer hangs on the issue. There could be *but* the sanction of an oath in the one case as in the other. Dr. Ure holds forth the pepper case, which we have just quoted, as being "an instructive example of the *fallacy of chemical evidence, sometimes too inconsiderately given in a court of justice,*" and it has been long unhappily but too notorious that there is almost no description of evidence, on which less reliance is to be placed. Had the *impossible* facts *sworn* to by Professor Graham and Mr. (George) Phillips not been disproved, as they luckily were, Messrs. Mayor and Dove would of course have been convicted. And if they had, they would not have been the first, we believe, by many thousands, who have been equally innocent sufferers from excise interference, and "the fallacy of chemical evidence."

Of the reprehensible carelessness (to speak mildly) with which scientific men give their evidence in such cases, there are also some striking proofs to be found under the head TOBACCO of the present Supplement. But before proceeding to these proofs, we feel tempted to set before our readers what Dr. Ure himself thinks of the excise system in general, and its tendencies in regard to manufacturing industry.

"When the duty on an article is more than ten times its intrinsic value, it must become the subject of perpetual and enormous frauds, and engender innumerable misdemeanours and crimes. Towards the prevention and punishment of these transgressions of the fiscal laws, a cumbrous, complex, costly, somewhat arbitrary and despotic system of espionage and prosecution must be organized. The working of this vast machinery is well shown in the Committee's Report, and must excite uncomfortable feelings in every honourable mind. We here see, on a somewhat magnified scale, the system of interference with, and prying into, processes of art and manufacture which accompanies and characterises all the operations of the excise. This device for collecting revenue for the necessities of the State is the Pandora's box of the dethroned Stuarts, and should have been expatriated with that ill-starred family. We may say of it, *Quicquid tangit, deornat.* No branch of industry can acquire its due developement under its wiry training and fastening, Had the *incubus* of the excise overlaid our textile manufactures of wool, cotton, flax, and silk, how dwarfish would their stature have remained, and how meanly would they have quailed under the unrestrained labour of rival nations, whereas now they afford employment, with food, raiment, and lodging, to millions of our people. For the manufacture of glass in all its useful and ornamental branches, this country possesses indigenous resources superior to those of every other one, in its stores of fuel and vitrifiable materials of every kind, and yet it is surpassed by France, Switzerland, and Bavaria, in glass for optical purposes, and by Bohemia in the quality and execution of decorative glass. Our scientific chemists have been obliged to get all their best glass apparatus from Germany, *viâ* Hamburgh.

"Surely our glass-makers are the same race of people as our manufacturers of iron, fine cotton yarn, muslin, bobbin-net, broad silks, &c., which defy the competition of the world, and if unshackled by the excise they would ere long turn the scale against their foreign rivals, now their superiors. The incessant and vexatious espionage of the excise is a bar to all invention in every art under its control. Who would expend thought, science, labour, and money in maturing any discovery or improvement, by experiments necessarily conducted under the eyes of needy excisemen, who would tell all they have seen for a trifling bribe? Perhaps the gigantic scale of our spirit distilleries may be appealed to in proof of the fostering care of the excise, under which they have been reared. But this overgrowth, when well looked into, is no evidence of a sound constitution, but merely of the depravity of a grovelling uneducated people. In fact, our distilleries produced, until very lately, a very impure and offensive spirit, strongly imbued with noxious *fusel-oil,* or

oil of grains (see ALCOHOL in this *Supplement*), and but for the recent introduction of Mr. Coffey's still into some distilleries, they would all have been yet sending forth a similar crude spirit. But though Mr. Coffey was for many years an officer of excise, and therefore did adapt his patent invention to all the just requirements of the revenue laws, he has met with very vexatious obstructions in the erection of his stills and on the most frivolous pretences.

"As a general corollary from my long experience in the conduct of arts and manufactures, I feel warranted to declare, that the excise system is totally incompatible with their healthy growth, and is in itself the fruitful parent of fraud, perjury, theft, and occasionally murder. The sooner this portion of the revenue, so oppressively, so expensively, and so offensively collected, is replaced by an equitable tax on property, the better for the welfare of this great country. I have no quarrel with the gentlemen who administer the excise laws; several of them with whom I have been professionally conversant, I esteem very highly as intelligent and upright men, who do what they deem their duty in a conscientious manner. But in concluding a very extensive survey of the great branches of our national industry, this vile obstacle to their progressive growth became so manifest, that it would have been pusillanimous to shrink from the task of pointing out the magnitude of the evil."

Now it is this very system which Dr. Ure here condemns so justly, which he would have applied to the manufacture of bread stuffs. His Board of Superintendence would be but another Board of Excise, exercising the like inquisitorial duties in a like questionable way, for the sake of the Public Health instead of the Public Revenue. He seems to us to approach much nearer the true remedy for the evils in question in what he says about the existing obstacles to the introduction into this country of the fine wheaten flour of the south of Europe. If our markets were but thrown freely open to *the best* possible as well as the largest possible supplies from all quarters—if those cruel laws which now operate to *force* inferior and damaged grain and flour into consumption, were but once swept away—we should have but little, we apprehend, to fear from the tricks of either miller or baker. People do not commonly adulterate for the mere sake of adulteration; they adulterate to make money by it. And all experience shows that there is no surer way of putting an end to the sale of base and spurious articles in any branch of trade, than to make the good and genuine, abundant and cheap.

To return now to the additional proofs contained in the article on TOBACCO, of the little reliance to be placed on the evidence of scientific men in questions of adulteration—such men as any sanatory Board or Boards would most probably be composed of—let us see what the author tells us on this head.

"*Tobácco.*—This important subject of our national revenue has been, during the last session of parliament, very fully investigated, in reference to the smuggling and adulteration carried to an enormous extent, and hitherto but little checked by all the efforts of the officers of the customs and excise. Mr. Joseph Hume, M.P., who moved the appointment of the committee of the House of Commons, and of which he was chairman, proposed a reduction of duty from 3*s*. 2*d*. a pound to 1*s*., as the only effectual remedy against these joint evils; but he was counteracted by Mr. Goulburn, chancellor of the exchequer, and a majority of the members of the committee, on the score that the state of the national finances did not permit such a defalcation of income as that reduction would occasion. It would appear, from a great mass of evidence, that much more tobacco is introduced illicitly than what duty is paid upon, and that very great adulterations are practised. The following statement shows the temptations:—

Virginia leaf costs	in bond	$3\frac{1}{2}d.$	per lb., the duty is	1,100	per cent.
Ditto strips	,,	$5\frac{1}{4}d.$	,,	700	,,
Kentucky leaf	,,	$3\frac{1}{4}d.$	,,	1,200	,,
Ditto strips	,,	$4\frac{3}{4}d.$	,,	800	,,
Havannah cigars	,,	8*s*.	,,	112	,,
Manilla cheroots	,,	6*s*.	,,	150	,,
East India cheroots		1*s*.	,,	900	,,
Negrohead and Cavendish		6*d*.	,,	1,800	,,

" Rates of duty on tobacco in foreign countries :—

		Per English Pound.
Austria—leaf tobacco		3*d.*
Belgium	ditto	¼*d.*
Bremen	ditto, ½ per cent, ad valorem	
Denmark leaves and stems		¼*d.*
Prussia	Zollverein States	2*d.*
Saxony	Zollverein States	2*d.*
Bavaria	Zollverein States	2*d.*
Brunswick	Zollverein States	2*d.*
Wurtemberg	Zollverein States	2*d.*
Frankfort on the Maine	Zollverein States	2*d.*
Other German States		½*d.*
Hamburgh	⅔ per cent. ad valorem.	
Holland	2 per cent. ad valorem.	
Ditto cigars		2*d.*
Ionian islands, leaf stems		2*d.*
Ditto,	manufactured	3*d.*
Russia	30 per cent. ad valorem on foreign.	
Sweden and Norway		about 1*d.*

" A strict royal monopoly (*régie*) exists in Austria Proper, France, Sardinia, the Duchies of Parma and Lucca, and the Grand Duchy of Tuscany; and in Portugal, Spain, Naples, and the States of the Church, the licence to manufacture is periodically sold to companies, which regulate the prices of tobacco as they please. It will be found that the situation of all these countries where the monopolies and high prices are kept up, is nearly the same, as to illicit trade in tobacco, as in England.

" In the years 1841, 1842, and 1843, the average revenue in this country on tobacco, at 3*s.* 2*d.* per lb., was 3,635,105*l.*

" The greater part of the committee's report is occupied with the examination of witnesses as to the extent, modes, facilities, and chief localities of the illicit trade. It exhibits a great body of very curious and useful information, and demonstrates, beyond a doubt, that no measure short of a reduction of the duty to 1*s.* per lb. can put a stop to it.

" The portion of the Report most interesting to the readers of the present work will probably be found to be the scientific evidence as to the means of detecting adulteration."—(*To be continued.*)

FALL OF A MILL AT OLDHAM.

Report of Messrs. Fairbairn and Bellhouse, C.E.

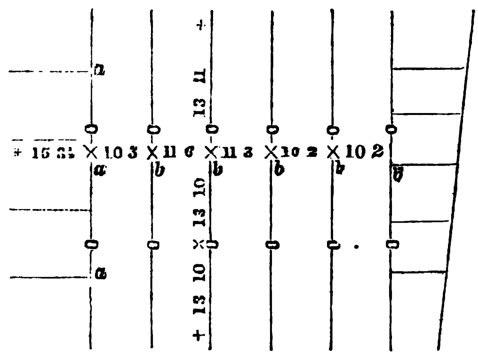
In consequence of an unanimous expression of feeling on the part of the coroner and jury, that a full and satisfactory inquiry should be made into the causes which led to the death of Joseph Tweedale and others, at Messrs. Radcliffe's cotton mill, Oldham, we have, in conformity with that request, carefully examined the building; and, having noted every particular relative to the walls, foundations, iron beams, columns, and their fractures, are of opinion that the accident has arisen from one of two causes—namely, from the falling of one of the arches in the first instance, or, what is more probable, from the breaking of one of the large beams supporting the transverse and longitudinal arches at the extreme gable of the mill in the other.

From the evidence already adduced, it appears that one of the arches in the top room, the fourth from the old mill, was observed to sink, some days previous to the accident which subsequently occurred. This arch, which had sunk about four inches, was considered unsafe, and the necessary preparations for refixing the centres were immediately taken for its renewal. During the re-building of the arch (of which about one-third was completed, the middle being removed, and the other remaining), the building at this critical period gave way; and, as stated by one of the witnesses, the beam broke short by the column, and the whole came down with a crash. Now, in this view of the case (and assuming the evidence to be correct), it is obvious the beam must have broken from the lateral strain of the arches, and not from the weight acting vertically (as assumed) upon the beams which remained. In confirmation of this opinion, it will be observed, that the middle beams were unprotected from the lateral thrust, unless we except an imperfect wooden stay, which from its soft and fibrous nature would easily split, or crush, by the force of the edge of a flanch of only one inch thick pressing upon it. Hence it follows, that the thrust of two wide and flat arches would be quite sufficient to fracture the beam, and thus loosen or destroy the abutment on each side. The beam being ruptured, it is easy to conceive the result which must inevitably follow such an event. From the breakage of this beam, we may infer a serious and extensive accident; but, to our minds, it does not sufficiently clear up the full amount of injury sustained; nor does it account for the immense crash and total destruction of the building which ultimately took place. One of the middle beams, or any one single beam, of the building giving way, could not, in our opinion, have made the ruin so complete; and having reason to suspect some other cause, we were induced to institute a still more minute and searching inquiry into the strength and proportions of other parts of the structure.

On a careful examination of the fractured beams, and more particularly of these which stretch transversely across the building, at a distance of 15 feet from the extreme gable of the mill, we found a more convincing

proof of the cause which led to this unfortunate occurrence.

These beams carry the ends of four other beams, which extend longitudinally from the gable on which they rest, as shown in the following sketch :—



From the above it will appear evident, that the beams *a*, *a*, *a*, had to support a much greater weight than the beams *b*, *b*, *b*, &c., and consequently they required to be made of proportionably greater strength. They were made stronger, but, unfortunately, from inadvertency, or rather from want of knowledge, they were strengthened in the wrong place, and instead of adding the additional strength to the bottom flanch, which is always subjected to the greater strain, it was given to the middle of the beam, where it was not required.

It is well known, or it ought to be known, to every person giving instructions for the form and construction of iron beams, that the strength is nearly a proportional of the section of the bottom rib or flanch, and according to Mr. Hodgkinson's experiments, a bottom flanch of double the size will give nearly double the strength.

These facts having been proved by direct experiment, it is important to all those concerned in the construction of fire-proof buildings, in which the lives of the public and the property of individuals are at stake, that the form of beams, and the section of greatest strength, should be perfectly and thoroughly understood, and those unacquainted with the subject we would beg to refer to Mr. Hodgkinson's paper on the strength of iron beams, in the 5th vol., second series, of the "Memoirs of the Literary and Philosophical Society of Manchester."

In ordinary cases we should not have troubled the jury with these remarks, but in cases of such importance as the present, where the lives of so many persons have been sacrificed to defective knowledge and skill in the construction of buildings, wherein considerations of such importance are involved, we have considered it our duty thus publicly to direct attention to the subject, not only as regards the present case, but respectfully to urge upon the proprietors of mills, and of other buildings containing workpeople, the necessity which exists for a more secure and perfect system of building, and for a further developement of the principles upon which fire-proof edifices are founded. If this suggestion is properly received and acted upon, we have reason to believe that we should not again have occasion to investigate occurrences of so lamentable and so distressing a nature as the present.

We have already observed that the beams *a*, *a*, *a*, in the preceding sketch, when strengthened, not, however, in the bottom flanch, but in the middle part of the beam, where they are thickened, and where it was absolutely of no use, had the same quantity of metal been given to the lower flanch, these beams (the weakest in the building) would have carried nearly double the weight, and thus, by a proper and judicious distribution of the metals, the building, as well as the lives of the people, would have been saved. These observations apply to all the other beams of the mill, which are also defective as respects their strength.

In computing the weights upon each beam, it was found that those supporting the arches of 10 feet 6 inches, and those of 11 feet 6 inches span, had to support a load

(without machinery) respectively of 10 and 11 tons, and those sustaining the ends of the longitudinal beams were acted upon with a load of 13¾ tons. Now, if we take the sections of these beams and calculate the weights necessary to break them, when laid upon the middle, it will be found that the breaking weights for the beams *a*, *a*, *a*, and *b*, *b*, *b*, &c., will be nearly the same, or about 9½ tons. This is the breaking weight of an average quality of iron, and allowing for the difference of metals, it could not be raised much above 10 or 10½ tons; the breaking weight would therefore be about 10 tons when the beam is loaded in the middle, and 20 tons when equally distributed over the whole surface of the projecting flanch of the beam.

Having ascertained the bearing powers of the beams, we shall next compare their strength with the actual loads they were called upon to sustain, and in making that comparison, it must be borne in mind that the two beams *a*, *a*, next the side wall, had their loads unequally distributed, which reduced their bearing powers to 5 tons. Now, the load which these beams had to support was 13¾ tons, 8½ tons being supported on a single point on one side, and 5¼ tons distributed over the surface of the opposite flanch on the other. From this it will be seen that the actual loads was to the breaking weight as the numbers 13·75 to 15, or as 1 to 1·09, being within a mere fraction, or 1·10, of absolute destruction.

Viewing the subject in this light, and taking the above calculations as data, we are no longer at a loss as to the cause of the accident; even supposing the arches to have stood, it will appear obvious that so close an approximation of the breaking weight to the actual load was extremely unsafe, and that under such circumstances no precautions could have prevented the rupture of the transverse beams *a*, *a*, *a*, whenever they happened to be subjected to the slightest impact or any vibratory motion tending to disturb the parts under strain, and eventually still further to lessen their diminished powers of resistance.

Irrespective of the weakness of the iron beams, which we consider as the primary cause of the accident, we would beg to advert to the tie-rods, which, although sufficient in number and strength, were not judiciously placed as respects their position for resisting the strain of the arch. Their *maximum* part of tension is at the bottom flanch of the beam; but that being inconvenient, they should on no account be placed higher than the soffit of the arch, and in this position they would perforate the neutral axis, and give sufficient security to the arch without injuring the strength of the beam; instead, however, of approaching this point, they were on the top of the beam, and 18 inches from the bottom flanch.

As respects the arches, we found the versed sine or rise of the arch too low; on most occasions they are 1¼ to the foot, but, in order to insure perfect security, we should advise, in all future buildings of this description, that the rise be 1½ inch to every foot of span. In this case they were only a small fraction above an inch, having a rise of only 12 inches in a space of 11 feet 6 inches.

On viewing the columns, several imperfections were observed in the variable thickness of the metal, but in other respects the pillars were satisfactory, and presented no features of weakness indicating danger from those parts; 1 inch more in diameter, with the same weight of metal, would, however, have given greater security and greater strength.

We cannot close this report without reverting to the anxious solicitude of Messrs. Radcliffe, and the strong desire evinced by those gentlemen to have every part of the structure upon the first and strongest principle; and we should imperfectly discharge our duty if we neglected, on this occurrence, to bear testimony to the superior strength of all parts of the building, except those we have just described, and on which it could not be expected they could form an opinion.

In conclusion, we have great pleasure in stating, that it appears to us that no pecuniary considerations whatever were present to the minds of Messrs. Radcliffe in the due and perfect construction of their mills.

After the preceding report had been read to the jury,

Mr. Fairbairn commented on the passages which had especial reference to the critical state of the building previous to the accident, and the consequent imminent danger of the mill. He and Mr. Bellhouse agreed in the opinion, that the vibratory action spoken of in the evidence, and produced by the causes set forth in the report, would be inevitably calculated to loosen the arches, and the whole would come down in a mass. The weakness of the beams, however, might be considered the primary cause of the accident.

A juryman observed, that it had been stated that the beams had been tested with a weight of 20 tons, and he was desirous of ascertaining, from the practical knowledge of the professional gentlemen then present, whether such a process might not permanently injure the beam subjected to a trial of the kind?

Mr. Fairbairn said it certainly might have

that effect; but explained the ease with which the extent of injury might be estimated. If, he observed, the beam did not restore itself—if its elasticity were not discovered to be complete, after subjecting it to such a test, it would not be trustworthy; the beam should return nearly to its former state, or proof would most undoubtedly be afforded that permanent injury was sustained.

Verdict.—"Accidental Death, caused by the falling of the building; and the jury are unanimously of opinion that the causes of the accident are fully pointed out by the able report of Messrs. Fairbairn and Bellhouse."

PATENT LAW CASES.

First Extension of Patent under the last Privy Council Act.

JUDICIAL COMMITTEE OF THE PRIVY COUNCIL, NOV. 7, 1844.

Present, the Vice Chancellor of England, Vice Chancellor Wigram, Dr. Lushington, Mr. Baron Parke, and the Right Hon. J. Bosanquet.

*Re Earl of Dundonald.**

Lord DUNDONALD appeared in person to support the prayer of his petition. His lordship explained the nature of his invention—stated that he had expended a large sum of money on it, and that it would require several years before he could expect to receive any remuneration; he therefore prayed their lordships for an extension of the patent for such a term of years as they might think proper.

After some conversation between their lordships, the VICE-CHANCELLOR inquired whether his lordship would object to give evidence on oath as to the expense he had been put to, and other questions it might be necessary to ask?

Lord DUNDONALD: No objection whatever.

His lordship was then sworn, and, in answer to questions by the Vice-Chancellor, said, that he was certain he had expended between 12,000*l.* and 14,000*l.* in carrying out his invention, and that he had not been reimbursed a single shilling; that attempts were now making to imitate his invention, and therefore he made this application.

The VICE CHANCELLOR: It appears your lordship has spent a large sum in carrying out this invention; is it likely to injure any one if carried into operation?

Lord DUNDONALD: Certainly not, my lords.

Mr. HENTON, engineer, was then examined. He thought that if the patent was carried out, it would be very advantageous to the public, and perfectly safe. He considered it the most valuable improvement in machinery which had been projected for the last forty years.

Mr. WADDINGTON (who appeared as counsel for the crown) said, he had no objection to the application, as, by the terms of the specification, the Crown, if it thought proper, could avail itself of the merits of the invention. He considered the success of the noble lord's invention of national importance.

The VICE-CHANCELLOR: I am of opinion that this is a proper case for the extension of a patent. What time will be sufficient to recompense his lordship? Will seven years be adequate?

Mr. HENTON: I should say not, my lord; it will take some years before any profit can arise. The Lords of the Admiralty have had the invention submitted to them.

Another consultation took place between their lordships, after which,

The VICE-CHANCELLOR (addressing Lord Dundonald) said, We are unanimously of opinion, that as your lordship has been put to great expense, without at present having received any remuneration, your application not being opposed by the Crown, and as it appears likely to be one of great advantage, and attended with safety to the public, the term of your patent ought to be extended; we shall, therefore, recommend her Majesty to extend the patent for the term of fourteen years.

COURT OF CHANCERY.

Thorneycroft and Gladstone v. *Jones.*

In this case a Bill had been filed by the plaintiffs, who are the proprietors of the

* The reader need hardly be reminded that it was at the instance of the Earl of Dundonald that the late Privy Council Act (which will be found at length in our Magazine of the 17th August last), extending the period for which letters patent may be renewed, from seven to fourteen years, was passed; and he will not, therefore, be surprised that his lordship should have been the first to avail himself of it. As little will it surprise any one who is acquainted with the merits of rotary engines in general, and Lord Dundonald's in particular, that there should have been no opposition to his lordship's application. A "Mr. Henton, engineer," it will be observed, gave it as his opinion, that the Dundonald rotary, was "the most valuable improvement in machinery which had been projected for the last forty years"! May we ask who this Mr. Henton is? Who ever heard of him before? Could nobody be found to give evidence on behalf of his lordship who was known to, and looked up to by, the public as an authority in such matters? Where were the Maudslays, the Fields, the Seawards, the Rennies, the Millers? One important lesson we may deduce from this case, and that is, that since the Privy Council have seen fit, on such slender evidence as that of this "Mr. Henton, engineer," to extend Lord Dundonald's patent for the full term of fourteen years, there can scarcely ever occur a case hereafter in which the like extension can be decently refused. Rare times for patentees!

patent for the scrap iron cutting machine described in the *Mechanics' Magazine*, vol. xli. p. 2, against the defendant for an infringement of the invention, and a motion was about to be made for an injunction, when the defendant abandoned all opposition, and agreed to take a license from the plaintiffs for the use of their machine.

COURT OF EXCHEQUER—MONDAY, NOV. 11.

Sittings in Banco.

Russell v. *Ledsam and others.*

In this case, which was an action for an infringement of a patent for welding iron tubes, and the trial of which had occupied Mr. Baron Alderson several days on two different occasions, (see *Mechanics' Magazine*, vol. xl, page 445,) Mr. KIRBY now moved for a rule *nisi* for liberty to enter up a verdict for the defendants on the seventh and ninth issues, pursuant to leave reserved by the learned judge who tried the cause for a new trial, on the ground of the verdict being perverse, and against the evidence; and to arrest the judgment, on the ground of the new patent granted to Mr. Russell, as "assignee" of the original inventor, having been granted contrary to law.

The Court was pleased to grant a rule *nisi* on all these points.

NOTES AND NOTICES.

Water by Railway.—The municipal authorities of Edinburgh and Leith, have entered into a provisional contract with the Committee of Management of the Caledonian Railway Company, for an amply supply of pure water to be conducted into these towns, along the line of the Railway. A similar use has been repeatedly proposed to be made of railways in England, and considering how manifest the advantages are of such a combination of important objects, it is surprising that it should never yet have been carried into effect.

Copper trade with India.—It appears from a statement in the *Swansea Journal*, that in "the years 1835-6, 1836-7, and 1837-8, the importation of this article amounted on an average to the value of 2,575,000 rupees (257,500*l.*), but the last of these years had so heavy a proportion as to cause a glut in the market, which was felt to some extent till 1841, when the average of three years was 2,126,000 rupees, or 212,600*l.* The trade then recovered rapidly, the average of 1841-2 and 1843-4 being 3,243,000 rupees, and the proportion of the latter year amounting to no less than 12 lakhs, or 420,000*l.*" The writer goes on to observe that as "the only use to which copper is as yet turned, is in manufacturing the domestic utensils of the Hindoos, who no sooner emerge from abject poverty, than they hasten to exchange their earthenware for dishes, and water-pots of brass," an increase in the demand for copper, shows an improvement in the social condition of the natives, which opens further prospects for British commerce.

Pickled Eggs.—In the counties of Hants and Dorset pickled eggs constitute a very prominent feature in the farmhouse store-rooms, insomuch that they would be considered by the industrious housewife but indifferently furnished without them. The mode in which the good dames pickle them is simply thus:—At the season of the year when their stock of eggs is plentiful, they cause some four or six dozen to be boiled in a capacious saucepan until they become quite hard. They then, after removing the shells, lay them carefully in large-mouthed jars, and pour over them scalding vinegar, well seasoned with whole pepper, allspice, a few races of ginger, and a few cloves of garlic. When cold they are bunged down close, and in a month are fit for use. Where eggs are plentiful, the above pickle is by no means expensive, and as an ascetic accompaniment to cold meat, it cannot be outrivalled for piquancy and *goût*.

Atlantic and Pacific Junction Canal.—A communication between the Atlantic and Pacific oceans, through the American Isthmus, would be of incalculable importance to the whole commercial world, but the difficulties opposing such an undertaking are greater than have, at first sight, appeared. Of the three parts at which a division of the isthmus has been proposed, that of Panama seems, at first, most favourable, as it is the narrowest; but, besides its bad climate, scanty population and meagre resources, it has been estimated that the work would require the co-operation of several nations and an expenditure of some 8,000,000*l.* At Nicaragua the distance is greater, but is intersected by a vast lake; yet the winding river of St. John, with its rapids and the mountain-chain towards the south, requiring, as some have stated, a tunnel to be driven through granite and porphyry, present great obstacles. The territory of Tehuantepec is considerably wider, but according to a survey just published, the practicability of the work is in an inverse ratio to the shortness of the distance, so that while it appears impossible at Panama, and immensely difficult at Nicaragua, it is comparatively easy at Tehuantepec. The advantages at this point are in the lagoons and extensive plains, good climate, a well-peopled country, rich soil, and abundant resources, the course of the Coatzacoalcos river, and its northerly situation favourable for vessels on their return from the Pacific.

Fatal Shell Experiments.—On Tuesday last a dreadful accident occurred on Wimbledon-common to an old soldier of the name of James Taylor, while assisting Dr. Ryan, of the Royal Polytechnic Institution, in a series of experiments on a new explosive shell, the invention of Mr. Buckingham. The shell is one of a peculiar construction, having no fusee, and resembling in its external character the common cannon ball. The inventor, however, professes to have so perfect a control over the missile, that by merely changing the position of the shell, as it is placed in the gun, it may be made to explode 1, 2, 3, or even fifteen minutes after it has been fired. Four or five dozen of these shells were fired during the morning under the direction of Dr. Ryan, who had been retained professionally to watch the results. Two of them, which ought to have exploded each a few minutes after leaving the gun, having remained quiet upwards of two hours, it was supposed that a failure had occurred. Dr. Ryan having left the ground to return to town, Mr. Buckingham and James Taylor proceeded to remove the unexploded shells. One of these had been already in the hands of two or three persons, when Taylor took it for the purpose of washing the earth off its surface. He was in the act of stooping when the shell burst, carrying away both the poor fellow's hands, and wounding him most dreadfully. Some faint hopes are, however, entertained of his recovery.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1111.] SATURDAY, NOVEMBER 23, 1844. [Price 3d.

Edited by J. C. Robertson, No. 166, Fleet-street.

THE ENGINES OF THE "GIPSY QUEEN."

Fig. 1.

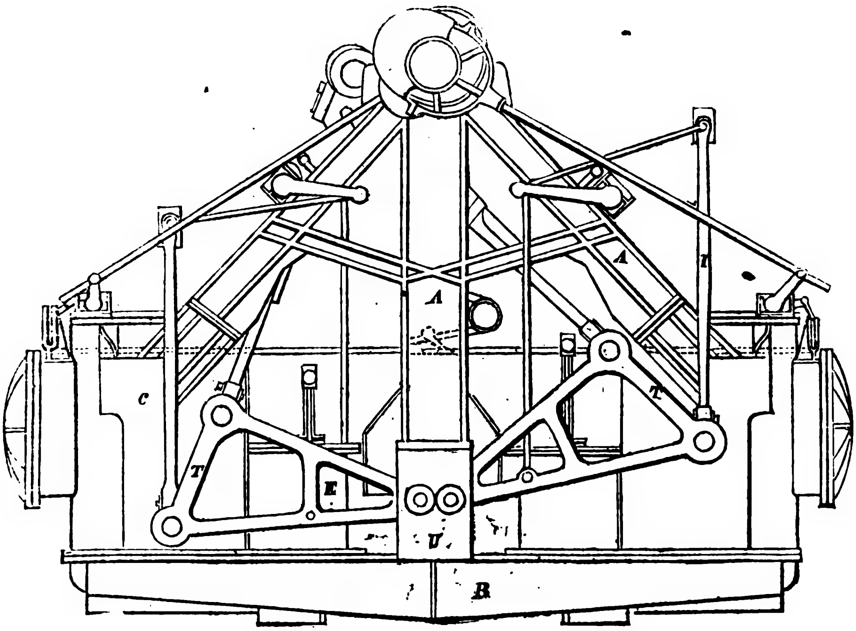
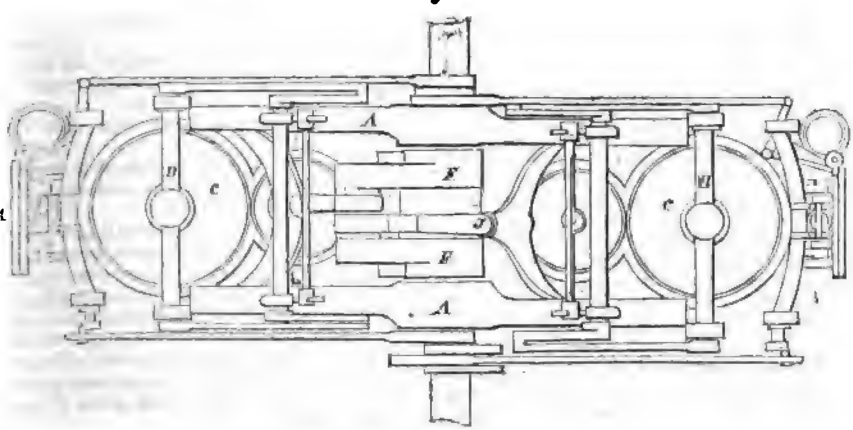


Fig 2.



THE ENGINES OF THE "GIPSY QUEEN" STEAMER.

The engines of this steamer were, as we stated in our last, on a new plan, of which the late lamented Mr. Jacob Samuda was the patentee; and were, we believe, the first built on that plan.

Fig. 1 of the prefixed engravings is an elevation of these engines, and fig. 2 a plan. The cylinders C, piston rods, cross-heads H, and slide rods J, are all constructed much as usual; but in the *first* place, the cylinders are fixed fore and aft, immediately over the keel—not exactly in a line with it, but "a little distance sideways, in opposite directions, so that the one connecting-rod clears the connecting-rod of the other engine;" *secondly*, in place of the ordinary side lever beams, iron triangles, T, moving on centres, U, are used to give motion to the connecting-rods, J; and *thirdly*, both connecting-rods are jointed to the same single pair of cranks, F; "no intermediate strong shaft being wanted; and thus one pair of cranks, and two frames and bearings, are dispensed with." The condensers are below the cylinders; the air-pumps E are worked from the triangles T, as shown in the figures.

THE FATAL EXPLOSION ON BOARD THE "GIPSY QUEEN."

[Conclusion of the Inquest on the bodies of Mr. Jacob Samuda, and six others.]

Town Hall, Poplar, Nov. 16.

Mr. Baker, the Coroner, on resuming the proceedings, observed that Mr. Hensman, a draughtsman, who was on board at the time of the accident, and Mr. Lowe, the engineer, had given some additional evidence on another inquest, held on the bodies of those who had died after their removal to the London Hospital, which would be repeated. The great question was, how to prevent such accidents occurring in future. A brother of one of the men who had died at the hospital, named Riley, and who was on board at the time, was satisfied that this was an accident. But if accidents from similar causes were to occur again, it was desirable for persons to know, that death from such a cause would then amount to manslaughter. In a case "The King *v.* Carr," reported in Carrington and Payne, it was held, where a man made a cannon, which burst, and it was sent back to him and repaired, and it burst a second time, that death from such repeated accident amounted to manslaughter. So in this case, if an accident from the same cause were repeated, he should have no hesitation in directing a jury to find a verdict of manslaughter. But Mr. Samuda, the engineer and chief owner, having paid the penalty of his life for this imperfectly constructed joint in the steam-pipe, he thought it would be harsh to bring in such a verdict against the younger brother and partner in the firm.

Mr. George Lowe was then further examined. If a collar or ring had been on the end of the spigot-joint, thinks it would have allowed for contraction or expansion, without permitting the pipe to be withdrawn from the socket. It was customary to have such a collar. Its own weight would keep the pipe in its place at a pressure of steam of 10 lbs. to the inch, but a pressure of 26 lbs. to the inch lifted the pipe out of the socket. The pressure indicated by the gauge below, when witness examined it along with Mr. Samuda, was 10 lbs.; it must have been 25 lbs. when witness got on deck; this was about five minutes after. (Mr. Hensman observed that it would take ten minutes to rise from 10 to 25 lbs. pressure.) There had been originally a ring or collar at the end of the spigot, but it had been chipped off. Had made enquiry, but could not discover by whom it was chipped, or by whose orders.

Mr. Henry Hensman examined. He thought the same pipe, if it had been joined with iron cement, would have been perfectly safe. He did not think that provision for the expansion and contraction of this joint was so absolutely necessary—the expansion of the middle joint being sufficient. The joint, as made and packed, would have been perfectly safe, if there had been a stay between it and the deck, or if it had been strapped with an iron strap to the engine, so as to prevent the pipe rising from its socket.

A Juryman.—Do you happen to know whether this pipe was new, or was part of the machinery of the old *Gipsy?*

Mr. Pim.—It was a new pipe cast for the purpose.

The Coroner read the following letter, which he had received on the subject of the accident from a Mr. Whitley:—

"Sir,—In the case at present under your notice there are several most important points which require your grave consideration. These points I had intended bringing forward to-morrow at the inquest; but not being able to attend, I have thought it advisable to adopt the present mode of addressing you, as my remarks can do no harm, and may tend to elucidate the cause of the fatal calamity.

"*First*, then; it was stated that the engines and boilers were fully competent to sustain the pressure, and that the only cause of accident was the increased pressure causing the 'spigot and faucet' joint to separate; but any statement relative to how this was caused was studiously omitted. Neither was it stated whether the vessel was provided with pipes leading from the boiler to the water with cocks or sluices in them, that might be opened, and relieve the boiler pipes, and valves, &c., from part of the increased pressure caused by the vessel's stopping, by allowing the steam to leave the vessel's side under water—a plan at present almost invariably adopted by engineers in vessels of modern construction. Drawings of the construction of the boiler and of the description of safety-valves employed—their diameter, and how loaded—with accurate descriptions of that part of the pipe which has given way, ought to be laid before the jury; as there are some singular circumstances attendant on the statement of Mr. Lowe, such as the steam showing at the gauge below a pressure of only 10 lbs. to the square inch, when, upon his arrival on deck, immediately after, it was blowing off, and that from valves loaded to 25 lbs. to the square inch, being an increase of pressure more than equal to 100 per cent. in a few seconds. The valve, it is acknowledged, was loaded to 25 lbs. to the square inch; yet, according to his evidence, the vessel started on an experimental trip, the engines having been previously worked at the moorings to ensure everything being correct, with a pressure of less than one quarter of that which was intended to have been employed; and during this trip the steam never reached beyond 10 lbs. to the square inch (at which pressure, it is stated, the engine made 24 revolutions per minute). The jury ought to press particularly to have a *full* and *accurate* statement of this part of the vessel, by which it might be ascertained whether the valves could be got at below to be tampered with by any one.

"Fortunately, Sir, accidents of the present nature have been extremely rare in this country, though not at all of unfrequent occurrence with our transatlantic neighbours; and now that such a calamity has befallen us, it ought, for the benefit of science, for the safety of the public, for the information of engineers, and for the interests of steamboat proprietors, to receive a most searching investigation. Mechanical men ought to be allowed to inspect the arrangements of the vessel; her engine room, though closed to the unceremonious visitation of an idle mob, ought to be open to practical men without distinction; and, indeed, enquiry ought to be courted by the owners. If all is correct, why endeavour to throw obstacles in the way of enquiry, by closing the engine room until *after* the finding of the verdict, when no facts could be brought to light, no more evidence adduced? If we are correct, we should, like Cæsar's wife, be above suspicion also.

"To you, Mr. Coroner, and to the jury, at the present moment the eyes of all mechanical men are directed; and it is hoped, from your known ability and impartiality, you will not suffer a verdict to be given without the cause being clearly ascertained. By knowing that, we have the remedy generally in our hands, and by that, the steam-engine will be advanced yet one step further towards perfection; but by not knowing it, an accident might (as stated by yourself) occur again in a few days, still more terrible in its effects.

"I am, Sir, &c.,

"E. WHITLEY.

"London, Friday, Nov. 15, 1844."

HENRY RILEY deposed that he had been seven years in the employment of Messrs. Samuda, off and on, and could speak to the talent and general assiduity of the deceased Mr. Samuda. There was no blame to attach to any one; it was an accident. His brother was one of the sufferers, and he was on board himself, and might have met a similar fate.

The CORONER.—Might not the spigot have chipped itself in coming out?

A JURYMAN.—No, that was not the case, evidently.

Mr. LOWE.—It had been not only chipped, but filed.

The Jury then retired to consider their verdict, and returned in about half an hour, having found a verdict of "Accidental death." They also expressed an opinion that the deaths of the deceased were "caused by the false and improper construction of the joint of the main steam pipe, in its not being sufficiently secured; and they express this opinion in order that due caution may be used to prevent similar accidents in future, which it appears to the jury may be effected by a collar or ring to prevent the severance of the pipes."

Remarks.

We subjoin some sketches which will convey to our readers a clearer idea than they will probably be able to derive from the evidence, of the faultiness in the construction of the steam pipes, which the jury have found to have been the cause of the accident.

Fig 1.

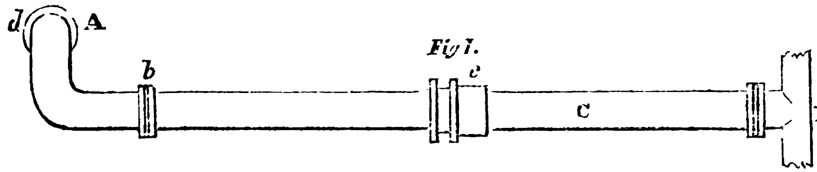


Fig 2.

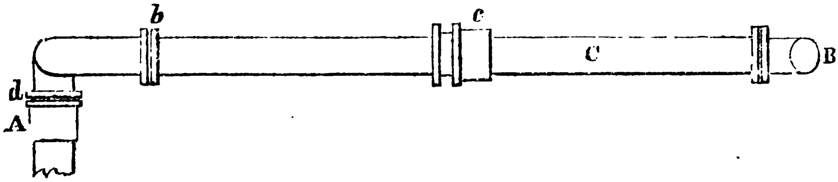


Fig 3.

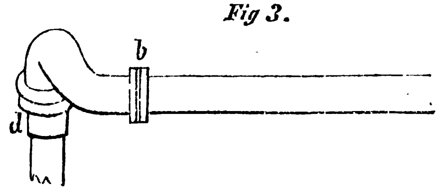


Fig. 4.

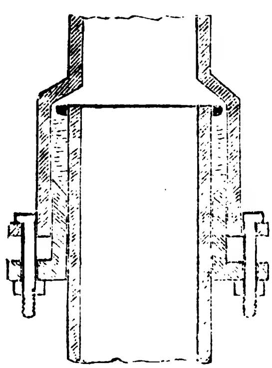


Fig. 1 is a plan or top view of the parts in question; fig. 2, an elevation or side view; fig. 3, a perspective view; and fig. 4 a separate view of one of the spigot and faucet joints.

A is one of the cylinders; B, the steam pipe leading from the boiler; C C, the intermediate steam pipes connecting A and B. The joints at *a a* were of the flange sort; those at *c* and *d* were spigot and faucet joints, packed with hemp and tallow, *d* being that which first gave way. The place occupied by the ring which was originally at the end of the spigot, but appeared to have been chipped *and filed* away, is indicated by the parts in black in fig. 4.

It is impossible for any person in the least acquainted with steam machinery, to look at the arrangements adopted in this instance, without being struck with their extreme defectiveness. The chipping and filing away of the spigot ring—an incomprehensible circumstance, which ought to have been more strictly enquired into—made that which is always a weak joint, the very weakest that could be contrived. Then the series of pipes, instead of having only one bend,

were first bent horizontally at right angles to the main line of the pipe C, and then again bent downwards at right angles towards the cylinder. And all this without there being a single strap or stay of any kind to maintain the pipes in their respective positions. The only wonder to us is, that they should have ever been able to withstand even 10 lbs. pressure. Taking the diameter of the faucet pipe to be 10 inches—which we presume to be pretty near the truth—this gives an area of 78·5 inches, which, at 10 lbs. pressure, made a total pressure of 785 lbs., tending to draw the pipes asunder; or, when the pressure was increased to 26 lbs., no less than 2041 lbs. A rupture, sooner or later, was, under such circumstances, inevitable.

Some additional points were raised in the sensible letter of Mr. Whitley to the Coroner, which deserved more attention than they received. We are particularly impressed with the discrepancy pointed out by this gentleman in the evidence of Mr. Lowe respecting the amount of pressure. In the evidence which Mr. Lowe gave on the first day's proceedings at the Inquest, he stated that Mr. Samuda and he looked at the steam gauge below, and found the pressure to be 10 lbs.; but that on going immediately after on deck, he found "the steam just oozing out at the safety-valve," and that the pressure must then have been about 25 lbs., as the valve was loaded to that amount. Now, is it possible that the pressure could in the brief interval which elapsed between the examination below, and the examination above, have risen from 10 to 25 lbs.?—Mr. Lowe states, in his second examination, that this interval may have amounted to "five minutes." We do not see how it could have amounted to half as much; but even in five minutes the thing is hardly possible. Mr. Hensman observed, that it would take "ten minutes" to produce such a rise; we should think more likely fifteen. Does there not then seem good reason to apprehend that there was something wrong with the safety valves? And would it not have been well in the jury to have ascertained how this matter stood before coming to the conclusion, that the steam-pipes alone were in fault?

THE REGISTRATION OF USEFUL DESIGNS.

Sir,—As it appears my observations on the Useful Designs Act are liable to misapprehension, you will, perhaps, favour me with a corner, that I may endeavour to prevent it.

I thought one of the principal advantages of the act was its affording a cheap and expeditious remedy for piracy—what that remedy turns out to be worth, a recent decision is a sufficient exemplification, and the necessity for an action at common law a sufficient commentary.

If we consider the matter calmly, I think we shall arrive at the conclusion, that it is next to impossible that magistrates should possess such knowledge, as would enable them to appreciate correctly all the various contrivances which are likely to be brought before them under this act, and qualify them to decide justly in all cases; and if they do not themselves understand the matter where are they to seek information? They do not seem authorised to call before them such persons as could explain the merits of the contrivance under consideration, or to seek assistance of any kind. But the law calls them to decide;—to decide a question which, in truth, they cannot comprehend. What are they to do? I confess it seems to me their only resource is to decide at once, right or wrong, and then "decline going further into the question."

Now these are defects in the Act which it must be to the advantage of all who are in any way interested in new inventions and improvements, (and as you very pertinently ask "who is not?") to have speedily remedied; and it was to these defects I wished more particularly to direct attention in my last paper, and not to the random remark of Mr. Clarkson, which could not have been of any consequence (except to himself) under a tolerably good arrangement.

To your question, "did the observation *need* any contradiction," I cannot reply without giving an opinion of the manner in which the case was conducted, which I do not choose to do. But I

must beg to remind you that in the present state of the law, such a court as the one you remark upon (*ante, p.* 330) is the best which is provided for affording summary redress; and if redress is not obtained there, the only remedy seems to be an action at law. Is this what you call "*cheap and speedy justice?*"

Yours, &c.,

S. Y., AN ENGINEER.

November 20, 1844.

SUMMARY OF EXPERIMENTS MADE WITH SCREW PROPELLER AND ROTARY ENGINES FITTED TO MR. BEALE'S TRIAL BOAT THE "PIGMY GIANT."

The *Pigmy Giant* was built of iron by Messrs. Ditchburn and Mare, of Blackwall; she is 38 feet long, and of 8 feet 6 in. beam; 4 feet deep; her draught of water at midship 2 feet; midship section immersed = 9 square feet; she drops at the stern when going well about 12 inches, and is built to draw one foot more at the stern than at the head. The boat was originally intended for government service, and is built from the lines of a man of war's pinnace. The engines and boilers used in the experiments, afterwards detailed, are the same as those described in No. 1056 of this journal. The furnace is urged by a fan. The calculations of the power of the engine contained in the Table, a vacuum has been added equal to a column of mercury of 20 inches, and the speed of the vessel through the water is the mean of various experiments. The weight of the valve and lever, together with Salter's spring balance, (which will amply allow for friction and steam cooling in pipes, &c.), are not taken into account. In the column showing the cubic feet of water pumped into the boiler, the contents of the plunger are taken as being equal to 11·6 cubic inches, and one-third is deducted from the gross amount for leakage, &c.

EXPERIMENTS WITH "PIGMY GIANT."

Pressure in lbs. on the square inch in engine.	Strokes of pump per minute.	Water pumped in boiler in cubic feet per hour.	No. of revolutions of engine.	Speed of piston in feet per minute.	Calculated horse power.	Number of revolutions of propeller.	Calculated speed of propeller.	Speed of boat through the water in miles per hour.	Strip in miles per hour.
12	22	5·92	68·75	251·8	2·39	90·15	4·09	3·82	·27
14	26	7·0	81·25	297·78	3·08	106·65	4·84	4·51	·33
16	30	8·08	93·75	343·59	3·85	123·05	5·59	5·22	·37
18	34	9·16	106·25	389·40	4·70	139·45	6·33	5·91	·42
20	37	9·96	115·62	423·74	5·51	151·85	6·90	6·42	·48
22	38	10·24	118·75	435·21	6·01	155·85	7·08	6·54	·54
24	40	10·78	125·	458·12	6·72	164·05	7·45	6·85	·60
26	42	11·32	131·25	481·03	7·47	172·25	7·82	7·18	·64
28	44	11·86	137·50	503·93	8·26	180·45	8·20	7·54	·66
30	45	12·12	140·62	514·62	8·88	184·55	8·38	7·69	·69
32	47	12·66	146·87	537·52	9·74	192·75	8·76	8·2	·74
34	48	12·94	150·	548·91	10·42	196·85	8·94	8·31	·81
36	50	13·46	156·25	572·65	11·37	205·05	9·32	8·42	·90
38	52	14·02	162·50	595·56	12·34	213·25	9·69	8·70	·99
40	53	14·28	165·62	606·99	13·10	217·35	9·87	8·84	1·03
42	55	14·82	171·87	629·90	14·14	225·55	10·25	9·14	1·11
44	56	15·10	175·	641·37	14·92	229·65	10·43	9·22	1·20
46	57	15·36	178·12	652·80	15·78	233·75	10·62	9·28	1·34
48	58	15·64	181·25	664·28	16·63	237·85	10·81	9·44	1·37
50	59	15·90	184·37	675·71	17·50	241·95	10·94	9·52	1·42
52	60	16·18	187·50	687·18	18·39	246·05	11·18	9·54	1·74
54	61	16·44	190·62	698·62	19·33	250·15	11·37	9·62	1·75
56	62	16·70	193·75	710·09	20·23	254·25	11·55	9·74	1·81
58	64	17·24	200·	733·	21·52	262·45	11·92	9·81	2·11
60	65	17·52	203·12	744·43	22·5	266·55	12·36	9·96	2·40

From the above Table, it will be perceived that this little vessel requires an extraordinary degree of pressure, to acquire anything like velocity, and al-

though no correct account of her consumption of fuel has been kept, I can state from personal observation that when exceeding a speed of 9½, her consumption of *best oven coke* is nearly 1 cwt. per hour.

The propeller with which the experiments were made was constructed by Mr. Joshua Taylor Beale, in imitation of Blaxland's, and is thus described by him in a paper originally intended for insertion in this journal: "Propeller is composed of 4 arms, and 4 segments of a screw, forming part of a four-threaded screw; its diameter 2 feet 1¼ inches, and 4 feet pitch; segments equal half radius surface of each ONE-FIFTH of THREE QUARTERS of a disc the diameter of the propeller; the arms may be round or *square;* the propelling surface = two-ninths of midship section of boat; midship section of boat = 9 square feet."

Mr. J. B. Beale has discovered that *one-fifth* of *three quarters*, or in other words, *three-twentieths* of a disc containing 510·7 square inches, will only contain 288, (this being the number of square inches in two-ninths of 9 square feet,) instead of 306, the number usually assigned to it by other mathematicians. I must confess I do not understand this; perhaps Mr. Beale will explain.

The Table, though not so perfect as could be wished, will enable the reader to form an opinion of this class of rotary engines, as it gives the *rotary* horse power requisite to propel 9 square feet of surface at a certain velocity. By comparing the results in this Table with others obtained by the ordinary reciprocating engine, we shall have data to estimate which class of engine gives out the greatest effect.

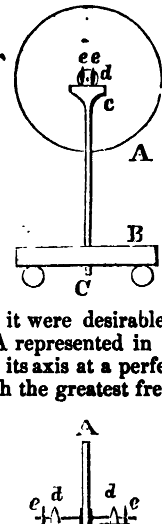
It may not be out of place to add, that with a propeller constructed by Mr. Blaxland for trial in this boat, a speed of 10·5 was realized, which was the greatest ever attained by the *Pigmy Giant.* The same propeller divested of two of its blades, and containing less propelling surface than *half* of "*one-fifth of three quarters* of a disc the diameter of the propeller," attained a speed of upwards of 10 miles per hour. A propeller of one semi-diameter, and with flat plates, when tried in this vessel, once reached a velocity of 6 miles per hour.

E. W. BAKER,
Late Engineer of *Prince of Wales.*

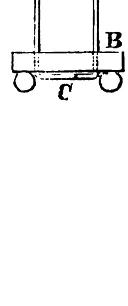
DELICATE ANTI-FRICTION APPARATUS.

Sir,—In many philosophical experiments it is still a desideratum to get rid, as much as possible, of friction. Important as this is in mechanics, what I shall at present confine myself to, will refer principally to delicate philosophical apparatus. The balancing of scale beams has been carried to a great nicety. The fine steel bearing of the axle in some cases, and in others its being laid on friction wheels, also reduces very much the amount of actual friction. Perhaps the most delicate method is that of employing a fine steel axis, and suspending it from a magnet; but in electro-magnetical experiments this might be objectionable.

In some experiments I wished to conduct with a disc, or wheel, suspended in the most susceptible manner possible, and consequently affected by the least possible amount of friction, I contrived an arrangement of which, as it is not without some novelty, and may be applied in a variety of ways, I now forward you, for the general information of your readers, the following sketch and description:—



Suppose it were desirable to suspend the wheel A represented in the annexed figure, with its axis at a perfect level, and turning with the greatest freedom;



Let A be the wheel, and provide a mahogany stand B, supported at its four corners by balls; pass through the centre of the glass U, the tube C, terminated at top with two small wooden troughs *c*, *c*, neatly cemented to the glass. Fill the tube with mercury and it will stand at the same level in *c* and *c*. Provide the wheel A with a slender steel axis run through two cork, wood, ivory, or hollow-glass balls, or wheels, *d d*; the axle passing through these is retained in its place by the upright pins *e e*; and the balls, or wheels *d d*, move freely on the surface of the mercury.

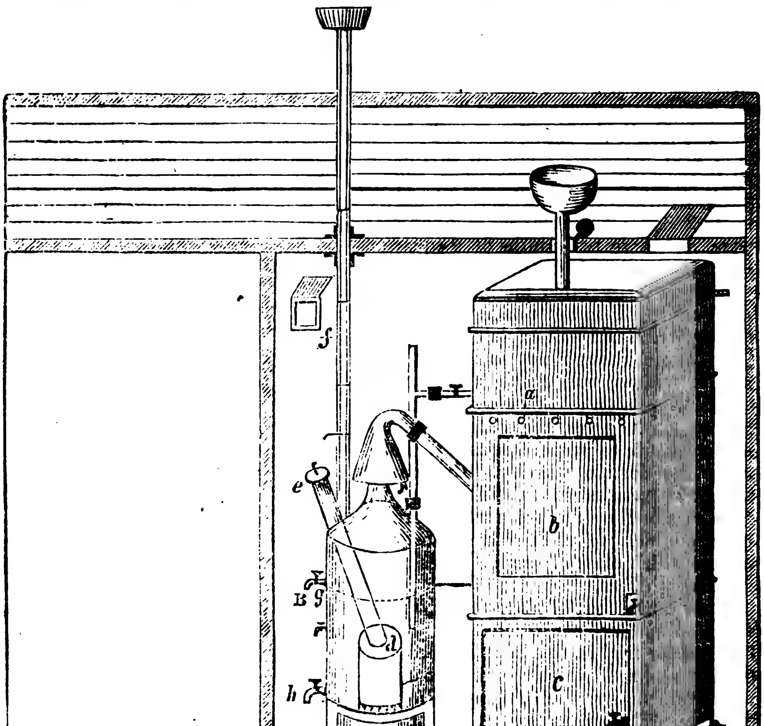
The friction here is obviously very little, and the true level is found without an effort. A scale beam might be arranged on the same principle, and would possibly possess some advantages. Although mercury is proposed, oil, water, or indeed any liquid, it is obvious, might be substituted.

I am, Sir, your obedient servant,

H. D.

Lincoln's Inn Fields, November, 1844.

CLARK'S PYRO-HYDRO-PNEUMATIC APPARATUS—ADAPTATION OF IT ON BOARD OF MERCHANT VESSELS, AND ON SEA SHORES FOR PURIFYING SEA WATER.



In our No. 1046, of last year, we published an abstract of the specification of the improved pyro-hydro-pneumatic apparatus invented and patented by Mr. Charles Clark, with a view to facilitate and cheapen the process of distillation generally, and in particular, to afford a safe, simple, and cheap means of purifying sea-water on board of ships at sea, as well as on marine shores, where fresh water is either totally wanting, or has to be fetched from a great distance; in which latter case it is not only expensive, but mostly also of a bad, unwholesome quality.

We learn that the apparatus has been

since then adopted on board of several merchant vessels with the most unqualified success; and for the information of such of our readers as are interested in shipping, we now give a drawing of the manner in which it has been fitted to two of these vessels, the *Wellington* of 307 tons, and the *Naples* packet of 159, and subjoin some further interesting particulars, confirmatory of the advantages to be derived from its use.

In the vessels we have just named, the apparatus has been fixed under deck (D), near the cabin, and is attended to by the cabin boy. In larger ships it has been placed on the galley, close to the hearth, where the ship's cook can easily attend to it.

A is the self-acting, condensing, aërating, purifying, and filtering part, consisting of a cistern *a*, at top, for holding the water to be purified; of the rectifier and condensing-steam chambers *b*, in the centre, and of a filtering refrigerator *c*, in which the pure product accumulates, at the bottom. The whole is manufactured of strong galvanised iron and zink, of great durability; particularly as there is no strain suffered to cause rapid wear and tear, and the cistern, holding the *impure* water, protects itself from corrosion by the stony coating, which in the course of time is found to form in it.

B is the boiler, or still, with an inner furnace *d*, constantly surrounded with water. This furnace is supplied with fuel from above, through a tube *e*, an upward branch *f*, from which it carries away the smoke.

These two vessels are connected by two very strong iron tubes, one of which, leading from the sea-water cistern to the boiler, serves for keeping the latter supplied with water up to the gauge tap *g*; while the other, leading from the still-head to the condenser, conveys the generated steam into the air chambers of the latter, for aërated liquefaction.

The steam pressure on the boiler is only between one and two pounds on the square inch (as regulated by a valve in the still head,) so that danger in this respect is entirely out of the question.

The working process is simple: the cistern being kept full of sea-water, a supply of it is introduced into the boiler once every hour, by turning on the supply cock, and some brine removed occasionally from the boiler by the lowest, or brine cock *h*. The process is thus continued for any length of time, without any other interruption than that of once in twenty-four hours putting out the fire, and clearing the boiler and cistern of the residuum, by letting it run out at the brine cock *h*.

It is, of course, necessary to keep the water in the boiler always above the furnace, at the height denoted by the second gauge tap; and there is no difficulty in doing so, by hourly attendance to the supply-cock. In order, however, to leave nothing to the chance of forgetfulness, the supply tube is provided with a supply-pipe and steam whistle *w* (called Hamer's), which gives a loud, lasting report as soon as a fresh charge is wanted.

The condenser is 5½ feet high by 26 inches square; the boiler 15 inches diameter, being, with the still head, 3½ feet high. Thus, the whole apparatus only occupies a space equal to one and a half water casks of the ordinary size; while the average produce of pure water, fit for immediate use, is 2½ gallons per hour, or 60 gallons per diem, by means of 90, or at most 120 lbs. of coal, according as the fire is attended to.

In a letter from Captain Brown, of the *Wellington*, to his owners, Messrs. Smith, Sundius, and Co., in London, he speaks in the following terms of the performance of the apparatus:—

"Off Algiers, 13th May, 1843—I have worked the Patent Still; the water is very good; we have made tea and soup of it, and tried it in every manner for both self and crew."

"Constantinople, 17th June—I find the machine answers well, producing water of the best quality, perfectly clear, cool, and very soft. The weather is at present so intensely hot, that the water here is not fit to drink; and the machine is also much admired for the small space it takes up; most of those who had heard of it imagined it to be a cumbersome affair until they had seen it."

"5th July—The salt-water still has created quite a sensation here, and it gives me great satisfaction in working; the water here being so very bad, it has become quite needful, and I seldom use any other."

The following is an extract from a still more recent letter from Capt. Brown to Mr. Clark:—

Dear Sir,—In addition to my previous Reports concerning the satisfactory working of your Patent Sea Water Still on board my ship, the *Wellington*, and which I have herewith pleasure to confirm to their full extent, I think it right to notice another favourable circumstance of great importance, namely,

that the cistern (at the top of the condenser holding the sea water for supplying the boiler) far from being weakened by corrosion in use, it acquires a protective stony coating, and thus becomes, if anything, stronger; nor does any other part of the condenser seem to suffer by oxidation at sea. This part of the apparatus thus appears to be of great durability, and likely greatly to outlast the furnace of the boiler, which, to judge by the one I have worked, I doubt not will remain good for about six years, if not longer, as only a moderate fire is required for distillation. The steam whistle is a valuable safeguard to the boiler.

I remain, dear Sir, yours respectfully,
EDWARD BROWN.

Brig Wellington, London Docks, 19 Nov. 1844.

An apparatus of the dimensions of that before described would even be sufficient for a ship of 600 tons, supposing her to carry no more than 60 men, including passengers. We subjoin a calculation with which we have been favoured of the cost for such a vessel during a nine months' voyage, say to Sydney and back.

Prime cost of the apparatus, presumed to last as long as iron steam boilers are found to do, say six years, 43*l*. 10*s*. Supposing the voyage out and home to take nine months, the proportion of the prime cost for such period is one-eighth, or	£5	8	9
The working of the apparatus during six months at sea, being 182 days, produces 10,920 imp. gallons of water, (half of which for 3 months is in bulk equal to 27½ tons, if carried in casks or tanks,) requires a stock of 5 tons of coal shipped in London for the voyage out, and 5 tons shipped at Sydney for the voyage home, together 10 tons, at 30*s*. per ton	£15	0	0
Add freight for 6 tons of room occupied by the coal and the apparatus, at 35*s*. per ton out, and 90*s*. home, is................	£37	10	0
	£57	18	9

Thus, the total expense for a nine months' voyage out and home, whereof six months are passed at sea, would be 57*l*. 18*s*. 9*d*., which is to be set against the proportionate cost of casks or tanks, (with incidental expenses) capable of holding 5,460 gallons of water, equal to 27½ of dead weight and bulk, to be carried out and home. The freight of this *alone*, (35*s*. out, and 190*s*. home,) would amount to 171*l*. 17*s*. 6*d*.

These results appear fully to warrant the patentee's assertion, that the expense incurred by the use of his apparatus, is only 25 per cent. of what attends a supply of much inferior water carried in tanks or casks. *Both modes of supply may therefore be advantageously combined.* Moreover, the dependence on tanks or casks is by no means perfect; both are subject to leakage, and the latter, when kept on deck, are frequently washed over board. If the apparatus be required to yield 120 gallons per diem, the increase in size is trifling, and the prime cost only 60*l*. (instead of 43*l*. 10*s*.)

By unscrewing the union joints of the tubes, the boiler is easily separated from the condenser; and such being the case, the machine is not only portable, but may be conveniently stowed away under deck, when not wanted. This circumstance makes it also very suitable and convenient for large merchant ships, and particularly for men-of-war, as one, two or more such apparatuses, being kept on board, may be easily brought upon deck, the two parts screwed together, lashed to the deck or bulwark, and set to work in moderate weather.

For land distillation, a quantity of 12½ gallons per hour, or 300 gallons per diem, can be produced by one boiler of moderate size, steaming either into three condensers, each 7 feet high, or into one condenser, 12 feet high, costing about 150*l*. Four such machines producing 1,200 gallons per diem, and lasting six years, would thus cost 600*l*., of which the proportion for one year is .	£100	0	0
Add two men's wages (one to work by day and the other by night) at 3*s*. each day for one year, or 310 working days	93	0	0
The produce in 310 days would be 372,000 gallons of water, requiring 275 to 330 tons of coal, at 30*s*. . .	495	0	0
The total expense per annum, therefore, amounts to	£688	0	0

for 372,000 gallons, or about 1*s*. for 27 gallons, reckoning the fuel at the very high price of 30*s*. per ton.

We understand that arrangements are in progress for introducing this apparatus in the Island of Ascension, where the want of water has been of late most severely felt. Many other tropical localities are in the same predicament and may be thus relieved.

Of the purity and salubrity of the water produced by Mr. Clark's system, the

following testimonial from Professor Pereira, of the London Hospital, furnishes strong evidence:—

"I have great pleasure in stating that I have inspected Mr. C. Clark's Improved Distillatory Apparatus for procuring fresh water at sea from salt water. The apparatus is remarkably compact, convenient, easily worked, and, I should think, well adapted for the purpose for which it was made. I examined some of the water which I saw distilled by it from sea water. Judging by the eye, the nose, and the palate, it appeared to me to be pure water. I have subsequently submitted it to some chemical tests, and find it to be devoid of all metallic and other noxious matter. I therefore believe it to be perfectly wholesome, and very superior to the fresh water usually found on ship-board."

DR. URE'S SUPPLEMENT TO HIS DICTIONARY—(SECOND NOTICE).

The principal witnesses on whom the Board of Excise have been recently accustomed to depend most for scientific evidence, to convict persons prosecuted for the adulteration of tobacco, have been Mr. Graham, Professor of Chemistry in the University College, London, Mr. Richard Phillips, Chemist and Curator to the Museum of Economic Geology, and Mr. George Phillips, an Examiner of Excise. Mr. Graham is a gentleman who gained his professorship by an academical reputation, which his subsequent labours can be scarcely said to have confirmed; he is the same who failed so notably in his analyses of the spurious naphtha, or sophisticated alcohol, a year or two ago (see *Mech. May.*, vol. xxxviii. p. 410.) Mr. Richard Phillips is one of our oldest and most experienced practical chemists. Mr. George Phillips is a person known only to the chemical world by his appearance as an excise witness; a "self educated" chemist, as he tells us, of no less than "two years'" standing, who "taught himself the principles of chemistry to enable him to make detections!" (Tobacco Report, 7774). Professor Graham, when questioned by the Commons' Committee as to his competency to detect adulterations in this article of commerce, stated that he could "distinguish the fibre of the tobacco leaf from any other leaf," that "there would be no difficulty in detecting 5 per cent. of any sort" of spurious intermixture; and that, "with the aid of the microscope" he could even detect "one per cent." of (vegetable) adulteration. Mr. George Phillips affirmed with equal confidence that there was "no difficulty in (detecting) mechanical adulteration," "*however small the quantity;*" that he "could distinguish the fibre of tobacco from the fibre of dock, or any other vegetable of the same family," and that it was "*impossible for any man to add* 5 *per cent. without detection.*" Mr. Richard Phillips differed somewhat from both his coadjutors; he was less confident, in the same proportion that he is probably better informed; he admitted that some intermixtures were difficult, others impossible of detection; and professed to be guided by negative tests only, such as obtaining alcohol from a solution of suspected tobacco, the genuine article being supposed to yield nothing of the sort.

To test the detective powers of these gentlemen, so much vaunted by two of them, and the worth of the evidence by which they had been the means of causing a great many persons to be convicted of fraudulent adulteration, the Committee took the following judicious and decisive course. They caused twelve samples of tobacco to be prepared and sealed up in their presence; three of them consisting of genuine tobacco, and the remaining nine purposely adulterated with various articles, in proportions varying from 4 to 12½ per cent. These samples were sent to the Board of Excise, and by them referred to Messrs. Graham, R. Phillips, and G. Phillips, in order that they might try their analytical skill upon them. After devoting twelve or thirteen days to an elaborate examination of them, the learned triumvirate made a joint report which furnished the following ludicrously-astounding results.

Some of the samples, which were indisputably genuine, they pronounced to be indisputably adulterated; and samples which were largely adulterated, they thought scarcely adul-

terated at all. Where 12½ of spurious matter had been added, they detected only 3·3 per cent.; where 10 per cent. 4; 9 per cent. 2; 8 per cent. 1! So much for its being "impossible to add 5 per cent without detection;" so much for detecting even "one per cent. of adulteration!"

Sugar they detected readily, not only in samples which contained it, but in samples which did not.

Sand they stumbled upon in heaps; though in not a single instance had sand been used as one of the adulterating ingredients.

In one sample they found leaves which they were sure were not tobacco, but what they were they could not tell—the boasted skill of Messrs. Graham and G. Phillips in distinguishing one leaf from another, notwithstanding. They thought they might "belong to a plant of the same natural family, probably the potato." In point of fact, they were leaves of the fox-glove, which is of quite a different family.

Of *ten* different articles with which the Committee's samples were adulterated—namely, terra japonica, carbonate of potash, carbonate of magnesia, carbonate of lime, nitrate of potash, sulphate of potash, common salt, crude nitrate of ammonia, alum, saltpetre, they *did not detect one!*

Never, in short, was there a more complete or disgraceful failure—never in all the annals of chemical pretension so miserable a case of *felo de se*. Out of their own mouths and crucibles—under their hands and seals—the unhappy trio stood convicted, of knowing nothing at all of the matters about which they professed to know so much!

Mr. Richard Phillips, who was in the first instance, as we have seen, the only diffident one of the three, became, when "the murder was out," the most obdurate of the lot. There was no prevailing with him to own that he had blundered so egregiously; where most contradicted, he insisted that he was only the more and more "confirmed;" and where his evidence was "shaken" all to pieces, he affected to think it firm as a rock. One specimen of the hardihood of his impenitence may suffice. When asked by the Committee how he could account for his having discovered a spurious addition of 3 per cent of sand and 2 per cent of sugar to one sample, when all that the Committee had added to it was some ounces of ground tobacco stalks, he answered boldly—*it came all of the stalks*. His namesake and associate, Mr. George Phillips, when afterwards asked, "could the introduction of 12 ounces of ground stalk into 13 pounds 9 ounces of tobacco, give an adulteration of 3 per cent of sand;" answered frankly, "*It is perfectly impossible*; the *stalk contains less sand than the leaf*."

It may be said that other chemists, as well as Messrs. Graham and Co., have found themselves at fault in their attempts to analyze samples of tobacco, and to separate what is genuine from what is spurious. This is true; even Dr. Ure, to whom a number of specimens were submitted by the Committee for analysis, arrived at results which were neither satisfactory to the Committee nor to himself. But there is this difference between the two parties. The Excise chemists pretend to be able to detect the slightest adulterations, and cannot; they convict numbers of persons by their pretended skill in detection; and they make money by this trafficking in convictions; (between January 1843, and July 1844, there were no less than 98 cases of alleged adulteration and 37 convictions); whereas, other chemists say that tobacco is a substance exceedingly difficult to analyze, and so easy to sophisticate, that spurious may be mistaken for genuine, and genuine for spurious, by the cleverest possible examiners; and this they say, having no false character as adulteration-detectors to sustain, and the interests of truth and justice alone to serve.

The triumvirate admitted on their cross-examination by the Committee, (for such it might be truly considered,) that the chief thing they looked to in their analyses of suspected specimens was the discovery of "saccharine matter," genuine tobacco containing none; and the presence of "saccharine matter" they held to be established in every case where they could obtain

spirit. The fallacy of this test was demonstrated in the course of the enquiry in various ways. In the first place, it was shown that the tobacco might be imported with an accidental intermixture of sugar, to the extent of even 10 or 12 per cent. without its being in the power of the merchant or manufacturer to detect by inspection its presence—in which case, of course, there could be no intentional adulteration for the sake of defrauding the revenue. Next, it was proved to be quite possible that saccharine matter might be produced by a decomposition and recomposition of the elements of genuine tobacco, though none of these elements was *per se* of that character.

Mr. E. Solly, F.R.S., examined:—"Can alcohol be obtained by fermentation of vegetables where *no sugar has been put in?*—Certainly.

"Have you yourself made that experiment?—I have made the experiment of producing alcohol from vegetable matter not containing sugar.

"Are there many materials common in vegetable matter which by fermentation may be converted into alcohol?—Many forms of starch may be converted into alcohol by fermentation; they pass first into sugar, and subsequently into spirit.

* * * *

"Can alcohol be obtained only from the fermentation of sugar itself?—Whatever substance produces alcohol must go through the intermediate stage of sugar.

"What other substances form sugar?—There are several varieties of gum and starch which may be fermented in the manner I have just stated.

"Then do you consider the mode by which saccharine matter is said to be detected at present, to be a good and sufficient test?—I should receive it with very great caution; I am by no means satisfied that *the production of alcohol from tobacco is any evidence that sugar has been added to it.*"

Of the effect of fermentation in forming new products wholly different and distinct from any contained in the fermented substance in its original state, Dr. Ure supplies the following remarkable illustration:—

"I shall advert merely to that marvellous metamorphosis which bitter almonds experience by contact of pure water; during which, aided by heat alone, the *solid inert matter* of the kernel is converted into a volatile, pungent, poisonous *ethereal oil*, mixed with hydrocyanic or prussic acid, a fluid *lighter than* water."—Art. TOBACCO.

We may ourselves mention, by the way, an experiment which will demonstrate even more conclusively, perhaps, than any of the proofs adduced to the Committee, the fallacy of regarding fermentation as an evidence of the previous presence of sugar; it has been kindly communicated to us by a chemical friend, by whom it has been repeatedly made with the like results. If you take equal weights of leaf tobacco as imported, and of roll or shag tobacco manufactured from leaf taken out of the same cask as the other; add to each an equal weight of boiling water; macerate both for the same time (say half an hour); next boil each for five minutes; then take an equal quantity of each of the strained liquors, add the same weight of yeast to each, and keep them at similar temperatures, you will produce fermentation in both decoctions, but the fermentation will be much more active in the *manufactured* than in the *unmanufactured tobacco*. Now, according to the conviction theory of the Excise chemists, this would be proof positive that sugar had been added in the course of manufacture, though, in point of fact, nothing of the sort took place. How then is the difference to be accounted for? It seems probable that during the process of manufacture—either when the leaf is moistened with water, or subsequently, when in a moist state it is subjected in the drying stove to a considerable degree of heat,—a change takes place amongst the proximate principles, and sugar is actually engendered. Or, perhaps, the tobacco may, during the process of manufacture, lose a considerable portion of its peculiar oil, and become in consequence thereof more susceptible of fermentation.

To return to the parliamentary evidence; the Excise chemists appeared to be in the habit of assuming, that whenever they were able to extract a *spirit* from a decoction of tobacco, that spirit must, as a matter of course, be alcohol—which it is agreed on all hands can only be produced from saccharine

matter. But it is scarcely necessary to say, that every spirit is not alcohol. The triumvirate ought to have subjected their supposed alcohol to some infallible test—to have converted it, for example, into ether, or made fulminating mercury by its means,—but this they seem never once to have thought of.

We should suppose that after this public exposure of the worthlessness of the evidence on which so many past convictions for the adulteration of tobacco have been obtained, and of the uncertainty which must attend every evidence confined to such limits as from 5 to 10 per cent., we shall not hear of many more excise prosecutions of this class, and that Messrs. Graham and Richard Phillips, at all events, will be slow to show their faces again as witnesses in support of them. (Mr. George Phillips having taught himself chemistry for no other purpose than "to make detections," may of course be expected to stick to his vocation.) Is adulteration, then, to be allowed to go on with impunity? By no means. How then is it to be put down? Simply by reducing the duty, as proposed by Mr. Hume. In the draft Report which that gentleman submitted to the Committee for their adoption, but which—for financial considerations solely—they rejected, it is observed on this head, "The honest trader ought to be protected; and by concurring testimony, the best and simplest remedy would be a reduction of the duty to 1*s*. per pound." Mr. H. N. Davis, the eminent tobacco broker, being asked, whether, supposing the duty were not to be reduced, he could suggest any other remedy? answered emphatically, "I think nothing but a reduction of the duty will answer the end; the manufacturers themselves have tried; they have sat in consultation for a number of months to frame a law for their own protection, and the detection of those who were dishonest; and when they had finished as they thought, *you could drive a wagon and eight horses through every clause*."

We have still some observations to offer on other parts of Dr. Ure's Supplement, but must reserve them till next week.

THE DISCOVERY OF ELECTRO-METALLURGY ESTABLISHED.

Sir,—In *June* last, and in several subsequent Numbers of your scientific miscellany, appeared my *Contributions towards a History of Electro-metallurgy*, proving that Mr. C. J. Jordan had precedence of Mr T. Spencer in the discovery of the application of the deposition of metals by galvanic agency for various objects of art. Your readers, and yourself in particular, will remember that I was immediately addressed, through the medium of your Journal, by Mr. Spencer, in no very measured terms, amounting to a declaration that I wrote from mere personal motives, and that he could, on abundant authority, prove his prior claim to being the originator of this beautiful and valuable art. Time only was wanting, and he intimated in decisive language his intention of setting the public right in the matter. Nearly six months have now elapsed, and Mr. Spencer has made no effort, beyond the broad and unestablished assertions then put forth, to rebut my statements. But indeed, I may well ask, How could he? for I supported all my arguments by most irrefragable evidence.

In your review of Mr. Shaw's work on electro-metallurgy, you have shown that due credit is given by that author to Mr. Jordan; and I now beg to furnish the following remarks from Dr. Ure's excellent "Supplement to his *Dictionary of Arts, Manufactures, and Mines*, 1844; an extract which it will be perceived, as far as regards facts, is a brief summary of my paper before-named.

"Electro-Metallurgy. By this elegant art, perfectly exact copies of any object can be made in copper, silver, gold, and some other metals, through the agency of voltaic electricity. The earliest application of this kind seems to have been practised about ten years ago, by Mr. Bessemer, of Camden-town, London, who deposited a coating of copper on lead castings, so as to produce antique heads in relief, about three or four inches in size. He contented himself with forming a few such ornaments for his mantel-piece; and though he made no secret of his purpose, he published nothing on the subject. A letter of the 22nd May, 1839, written by Mr. J. C. (should be C. J.) Jordan, which appeared in the *Mechanics' Mag.* for *June* 8, following,

contains the first printed notice of the manipulation requisite for obtaining electro-metallic casts; and TO THIS GENTLEMAN, THEREFORE, THE WORLD IS INDEBTED FOR THE FIRST DISCOVERY OF THIS NEW AND IMPORTANT APPLICATION OF SCIENCE TO THE USES OF LIFE.* It appears that Mr. Jordan had made his experiments in the preceding summer, and having become otherwise busily occupied, did not think of publishing till he observed a vague statement in the journals, that Professor Jacobi, of St. Petersburg, had done something of the same kind. Mr. Jordan's apparatus consisted of a glass tube closed at one extremity with a plug of plaster of Paris, and nearly filled with a solution of sulphate of copper. This tube, and its contents, were immersed in a solution of common salt. A plate of copper was plunged in the cupreous solution, and was connected by means of a wire and solder, with a zink plate dipped in the brine. A slow electric action was thus established through the moist plaster, and copper was deposited on the metal in a thin plate, corresponding to the former in smoothness and polish; so that when he used an engraved metal matrix, he obtained an impression of it by this electric agency. 'On detaching the precipitated metal,' says he, 'the most delicate and superficial markings, from the fine particles of powder used in polishing, to the deeper touches of a needle or graver, exhibited their correspondent impressions in relief with great fidelity. It is, therefore, evident that this principle will admit of improvement, and that casts and moulds may be obtained from those other metals having an electro-negative relation to the zink plate of the battery. With this view a common printing type was substituted for the copper plate, and treated in the same manner. This, also, was successful; the reduced copper coated that portion of the type immersed in the solution. This, when removed, was found to be a perfect matrix, and might be employed for the purpose of casting, where time is not an object.' 'Casts may probably be obtained from a plaster surface surrounding a plate of copper, &c.'

"On the 12th September following the above publication, Mr. Thomas Spencer read a paper 'On Voltaic Electricity applied to the purposes of working in Metal,' before the Polytechnic Society of Liverpool; which he had intended to present to the British Association at Birmingham, in the preceding August; but not being well received there, he exhibited merely some electro-metallic casts which he had prepared. The society published Mr. Spencer's paper, and thereby served to give rapid diffusion to the practice of electro-metallurgy."

I omit the remaining three pages and a half of this interesting article, my only object being to show that we have here a second and high scientific authority adopting the opinion I promulgated, in regard to the history of this very scientific discovery, and which at the period of its publication gave much offence to Mr. Spencer. His refraining so long from fulfilling his promise of a refutation can neither arise from apathy nor indifference, and it must, therefore, appear evident to all who are acquainted with the circumstances of the case, that his silence implies assent to the correctness and justness of my early well-meant criticisms.

I am, yours obediently,

HENRY DIRCKS.

77, King William-street, City, Nov. 18, 1844.

* I have purposely distinguished this handsome and merited compliment paid by Dr. Ure to the discoverer of electrography.

THE "WONDER" STEAMER.

Sir,—Your Correspondent, R. W., has admitted, in his letter to you, that accurate trials by the measured mile, are the most satisfactory; but I am at a loss to imagine how, with the smallest regard to consistency, he can do so, while attempting at the same time to justify to your readers the assumption before made, and still persisted in without proof, regarding the speed claimed for the *Wonder*.

Far from agreeing with the statement made by R. W., I maintain, in direct contradiction to it, that in placing this matter in its true light before your readers, I have at least established *one useful fact*, namely, that there *is nothing in all that has been said* that can in the *least degree* justify the assertion that a speed of 17½ miles per hour has yet been realized on the Thames; and replete as R. W.'s letter is with incorrect statements, he has prudently abstained, in the midst of all this, from anything like an attempt to controvert the opinion I ventured to give, that the *Wonder* has not exceeded 16 miles

per hour by fair steaming; and I contend, that all his remarks about having beaten the *Flying Eclipse*, which, as he says, commonly beat the *Prince of Wales* by three quarters of an hour to Margate, and of having beaten the *Royal Yacht* a full hour from the Nore to Woolwich; and, in addition, the best of the Gravesend boats, except to mystify the real question, can be useful only in one other way, and in fact does not advance our knowledge respecting the absolute speed of the vessel in the least degree.

The following extract from a notice respecting the trial of the *Wonder*, page 410 in the *Engineer and Architect's Journal*, for this month, will serve at least to show that the "*opinion*" I ventured to give in my former letter regarding the uncertainty of such *a mode* of trying the speed, is, in fact, completely borne out. It is as follows:—

"She ran the mile distance in 4 minutes 17 seconds against tide, being a velocity equal to 14 miles per hour, the tide running at the time about $2\frac{1}{2}$ miles per hour."

Here, then, as I presupposed in my letter of 17th Oct., is first a difference in the estimation of the rate of the tide of half a mile per hour, and then (as I suspected might happen) another difference of half a mile per hour in the ascertained speed when running the mile; making $16\frac{1}{2}$ miles per hour instead of $17\frac{1}{2}$ miles, as in the Report in your number of the 5th Oct., page 259, and although from the time of running the mile being given in this statement, more dependence may be placed on it, I continue to object to the guess about the rate of the tide, which leaves the matter still open to considerable uncertainty, and completely confirms my first impressions. I am, Sir, &c.

MERCATOR.

London, 15th Nov. 1844.

SCREW PROPELLING.

Sir,—Having copied from *The Times* of the 30th ult. a letter on the subject of Screw-propelling, by Major E. P. White, without inserting my reply thereto in the following number of the *Mechanic's Magazine*, I take the liberty of handing you a copy of the same, extracted from *The Times*, of the 2nd inst., under an impression that it may have escaped your notice, and that you will, from the usual spirit of fairness that characterizes the pages of your journal, yet do me the justice of causing it to appear.

I am, Sir, your obedient servant,

F. P. SMITH.

Ship Propeller Company's Office,
25, Finsbury Pavement, Nov. 14.

To the Editor of the Times.

Sir,—In reply to a letter in *The Times* of the 30th ult., dated Maidstone, Oct. 24, 1844, and signed by Major E. P. White, I beg to say, that as its contents appear to me only a renewal of the observations of his brother officer, Colonel Sir James Colleton, published in the *United Service Gazette*, of the 2nd of December last, I should think it unnecessary to do more than to refer your correspondent to my reply in that journal of the 16th of the same month, but that I feel at a loss to know upon what grounds Major White makes the following assertion, viz.—"He (Mr. Smith) is quite aware that I am perfectly acquainted with the whole of the circumstances connected with the invention, and how he became possessed of it."

Now, Sir, as I do most truly declare that I never had the slightest communication either with Captain du Vernet or any other person whatsoever on the subject of his propeller till long after the date of my patent, I call upon Major White to produce to the world all he professes to know on this matter, or at once to exonerate me from the charges which I can only conceive to have been made by him through some misapprehension of the circumstances.

F. P. SMITH.

Ship Propeller Company's Office,
25, Finsbury Pavement, Nov. 1.

[Mr. Smith has since addressed another letter to the *Times*, of which the following is a copy.]

Sir,—Will you permit me to remind Major White, that a fortnight has elapsed without his having in any way noticed my reply to his letter that appeared in the *Times* of the 30th ult., referring to the experiments on screw-propelling by the late Captain du Vernet.

Although I am willing to admit that Major White may have a praiseworthy object in view in attempting to establish the claims of his deceased brother officer, yet, as I feel that he can have no just cause to do so to the prejudice of my reputation, I trust that, however disagreeable he may find a newspaper controversy on the subject, he will now see the necessity of stating his grounds for the accusation of piracy with which he has charged me, or at once acknowledging the inaccuracy of the information he professes to have obtained on the matter in question.

F. P. SMITH.

Ship Propeller Company's Office,
25, Finsbury Pavement, Nov. 18.

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Edited by J. C. Robertson, No. 166, Fleet-street.

HANKINS'S PEDIMECHAN, OR SPRING PROPELLER.

Fig. 1.

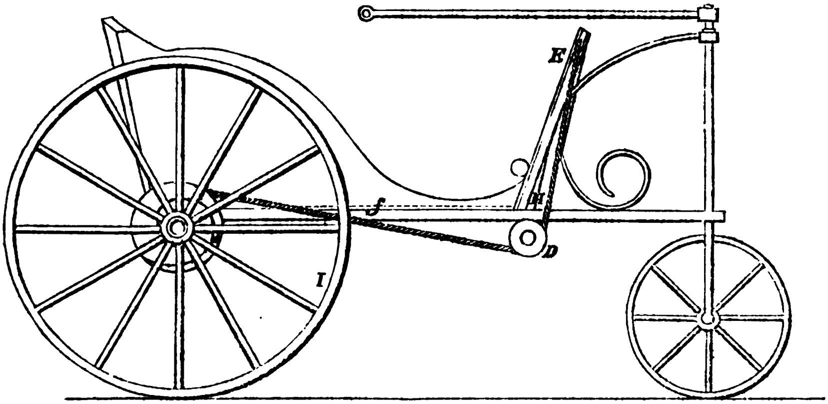


Fig. 2.

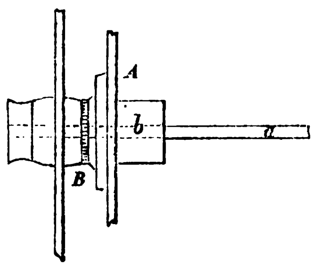
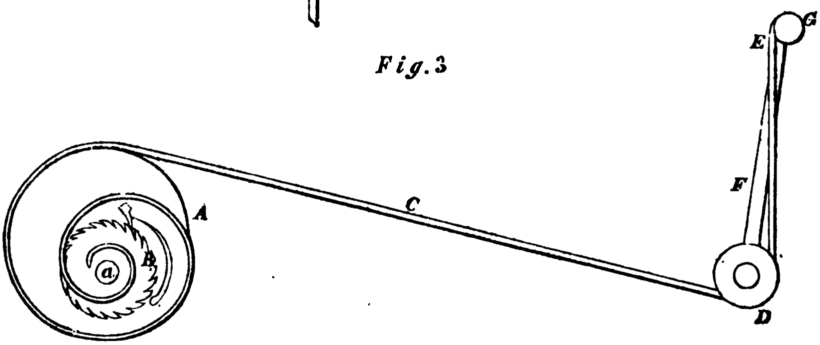


Fig. 3



HANKINS'S PEDIMECHAN, OR SPRING PROPELLER.

[Registered under the Act for Protection of Articles of Utility.—Mr. Jacob Hankins, of Farningham, Kent, Watchmaker, Inventor. Messrs. Deane, Dray, and Deane, Finsbury Iron Works, 86, Chiswell-street, Manufacturers.]

A GREAT many plausible schemes have been proposed for the better application of human strength to propelling purposes; but as yet we seem to have made but small advances in this respect beyond our remotest forefathers. We can row or skull a boat or wheel a barrow, as well as they could a thousand years ago—but no better; and boats and barrows are still the only vehicles ordinarily propelled by human bone and muscle. Of the numerous velocipedes, pedomotors, manumotors, &c., which have been brought before the public during the last thirty years, not one appears to have had any better fortune, than to be talked of for a time, tried by a few, and ultimately neglected by all. What ought we reasonably to infer from this common failure? Is it not, that there must be something in the human frame, which unfits it for the performance of more as a locomotive agent, than it has achieved of old by "flood and (brick) field?" We mean, of course, *continual* and *habitual* performance. That a man can by the aid of machinery propel himself, with a considerable weight besides, on highways and byeways, at much greater rates of speed than he can walk or run, has been experimentally demonstrated over and over again; but it has never, to the best of our knowledge, been shown that he can do so, for such a number of hours per day, and for such a number of days successively, (with no more than the exhaustion which belongs to everyday work,) as to make it more advantageous to employ his own strength in such labour, than the strength of the horse or mule. The question to be solved is one more of an economical than mechanical nature; and we presume to think, that if it could have been solved in the affirmative, we should not have arrived at the year 1844, without some one of the many machines of this class which have been successful, to the extent of accomplishing six, seven, and eight miles an hour, having come into general use.

Nevertheless, it is not to be denied that, even within the limits of occasional use, there is abundant room for the employment of such carriages with advantage. As a means of healthful exercise, or of conveying despatches on an emergency, their utility is unquestionable. A machine of this sort, is like a horse standing always ready saddled and bridled, with this material difference, that it costs nothing for its keep. On railways, and in the vicinity of railways—either for conveying passengers to them, or (when the steam horses are taking their rest) along them—such an auxiliary offers many obvious advantages. We know of one railway in the North on which Sunday travelling by *steam* is prohibited; but along which the inhabitants of a particular hamlet, are in the practice of propelling themselves to church every Sunday, in a pedomotive carriage contrived by one of their number.

The peculiarity of the machine which we have now to bring under the notice of our readers, consists in its embodying an ingenious application of spring power to the purpose in view. Fig. 1 represents it as applied to a common road one-man carriage. Figs. 2 and 3 are detached views of the principal parts.

A (fig. 2 and 3) is a truncated cone having a *spiral* groove, similar to the fusee of a watch, which is free to revolve upon the shaft *a*; *b* is a box which contains a *spiral* spring attached at one end to the box, and at the other to the fusee, so that when the fusee is pulled forward on its being liberated, it is brought back to its former position by the spring. B is a ratchet wheel attached to any other wheel, to which it is wished to communicate a rotary motion. C is a cord or chain affixed to the fusee at the one end, the other being passed under the pulley D, and carried up to some fixed point E, where it is made fast. F is a treadle or foot board, hinged at the upper end G to any fixed frame, the pulley D being attached to the lower end. When the treadle is pushed forward, the cord draws round the fusee in that direction, while at the same time it communicates a like motion to the wheel upon which the ratchet is attached.

When the driver presses forward the foot board H, (fig. 1,) the cord is also

drawn forward by the pulley D, and communicates motion to the fusee A and the wheel I, to which it is attached. Upon the pressure of the foot being taken off from the treadle H, the spring draws back the fusee, and by winding up the cord, also draws back the foot board H to its original position, ready for another application of the pressure, so that, by successively pressing the board H, rotary motion is communicated to the wheel.

The part of the carriage frame E, to which the cord is attached, is hinged at its lower end, and on being brought into the position indicated by the dotted lines *f*, the carriage will travel over nearly double the distance with the same angular velocity of the treadle that it does when the part E is in the other position represented.

WARMING AND VENTILATION.

Sir,—If I have rightly understood the purport of Mr. Coxworthy's objection to the particular application of his system of warming and ventilating, which I submitted in your Number for October, page 232, I cannot help thinking that he has taken it up on insufficient grounds. As Mr. C. will agree with me as to the utility of the plan, if practically available, I beg room for a few words for the purpose of removing the objection he has urged against it.

After assuring me that turning the heat of the kitchen chimney to account had not escaped his attention, Mr. C. proceeds, p. 261, to say, "It is to be observed that every proper kitchen grate has its boiler and oven, which entirely surround the back and sides of the fire, and that to admit of vessels being readily put on and taken off the fire, the opening in the chimney must necessarily be large; and as the rate of combustion and temperature of the fire are governed by the amount of opening in the fireplace, it appears to me that the throwing of any more cold air into the flue, or in any other way reducing the temperature of the smoke, would infallibly arrest its ascent, to say nothing of counter currents." I presume Mr. C.'s meaning in this passage, and the inference he intends to be drawn from it is this,—that as the circulation of a current of cold air around the outside of the iron flue must abstract a great portion of heat from it, there would be danger, from the large quantity of cold air which also finds its way *into* the flue, through the wide opening of the fireplace, that the temperature of the smoke would be so reduced as to counteract its ascent; hence, that the proposed arrangement is unsuitable for such a fireplace, and, by consequence, any other open fireplace, and is only adapted for a stove or a fireplace so constructed that the admission of air can be regulated and restricted.

Now there is a fact or phenomenon of every-day occurrence, with which Mr. C.'s views appear to me quite irreconcilable. When a fire is newly lighted in an open fireplace, of any kind, the grate, the fireplace, and the chimney are all in a cold state; the fire itself is a feeble sprinkling of lighted embers at the bottom of the grate, the influence of which is not even felt through the mass of the fuel above it. In these adverse circumstances it would seem impossible, on Mr. C.'s views, for the smoke to ascend; still it does ascend, making its way through the interstices of the cold superincumbent fuel, meeting with cold air in the fireplace and in its progress up the chimney, and surrounded by a mass of cold materials, ready, one would think, to rob it of the small portion of heat which it is bearing upwards, or rather, perhaps, by which it is itself borne upwards. It may be that the ascensional power of the smoke in this case is at *a minimum;* but the fact of its ascending under such circumstances is at variance with the opinion implied in the above quotation, that the cooling of the flue or chimney in which it is ascending, or the passing of any quantity of cold air into it, can so far reduce the temperature of the smoke as infallibly to arrest its ascent. In the plan I proposed, it is impossible, as long as the fire is maintained, that the condition of the flue, or the circumstances affecting the ascent of the smoke, can be so adverse to it as in the case just stated. However good a conductor the iron of the flue may be, it cannot receive and give off its acquired heat in the same instant; nor can the air circulating around it, which is a bad conductor, abstract the heat so quickly from it as to reduce the temperature of the flue anything near that of its own, or of the air entering by

the fire-place. Besides all this, however wide the opening of the fireplace, it would not be difficult so to adjust the aperture at the throat of the flue, and the form of the upper part of the iron casing, as to cause whatever air enters the flue first to receive a considerable accession of temperature in its course, both directly from the fire, and from the reflected heat of the casing.

I am, Sir, &c.

N. N. L.

November, 1844.

DISCOURAGEMENT FOR PERPETUAL MOTIONISTS AND MECHANICAL SCHEMERS.

Sir,—In his excellent treatise on "Popular Mathematics," Mr. Mudie, in speaking of the effect of impossible quantity to mar the efficiency of schemes which in every respect had worn the flattering appearance of being perfect, makes some very cogent remarks, worthy of being kept constantly in view by inventors generally.

He says, "Of the vast number of inventions and projects which are every day brought before the public, not as mere bubbles or impostures, but with perfect honesty and zeal on the part of the projectors, we speak with most charitable liberality when we say that not one in the hundred proves to be of any use, and nine out of every ten are altogether impracticable. The reason clearly is, that neither the projectors, nor those by whom they are encouraged, are able to see the impossible elements which their schemes involve; that they look at the possible and promising ones only; and thus a large quantity of well-meant labour and ingenuity is constantly wasted."

This overlooking of "some lurking impossible quantity," is tantamount to forgetting that a machine is "no stronger than its *weakest* part." In illustration of the serious mechanical errors consequently committed, Mr. Mudie says, "Perhaps, we cannot select a better one than that of the 'perpetual motion;' that is, a self-moving machine, which shall not involve any cause of stoppage, save the wearing out of the materials of which it is composed. We believe that the fonder votaries of this visionary project do not take even the wearing out of the materials into the account; but it is necessary to do this; and even this necessity, when analysed, involves the necessity of the machine stopping before the parts are worn out."

After commenting familiarly on the tendency of gravitation "to bring every piece, and combination of pieces, of matter, to a state of rest," he proceeds, "The power which tends to stop the motion of all machines upon the earth's surface is, then, a power which acts constantly and uniformly, never pausing an instant, nor abating a jot; and therefore, in order to get the better of this gravitation, we must have a counteracting power as continually new as itself; and we are not acquainted with any such power, or kind of matter in which such a power could reside. It is not difficult to calculate (upon mathematical principles) that if we could give any piece of matter a motion round the earth at the rate of about 5 miles in a second, or 1,800 miles in an hour, and *keep up* the motion at this rate, we should overcome the gravitation of that piece of matter. This is what may be regarded as the possible case of the perpetual motion.

"In the case of a fixed machine—and the more complicated the machine is, it is the less likely to succeed—the impossible element, in the most simple view we can take of it, is this,—to find a piece of matter which, of itself, shall be alternately greater and less than itself, and which shall also remain equal to itself all the time; and if this is not an impossibility, it is not easy to see where impossibility is to be found.

"The knowledge of impossible or absurd quantities, and the method of readily discovering them, are often of great use to us, not only in preventing us from wasting our time in attempting to do that which cannot in the nature of things be done, but in enabling us to prove or demonstrate truth in cases where that cannot be done directly."—(Ed. 1836, pp. 23—27.)

Hoping these observations may have their due weight with those inventors who possess the dangerous "little knowledge" which leads to so many erroneous conceptions in the projecting of mechanical improvements,

I remain, Sir,

Your obedient servant,

H.

November 23, 1844.

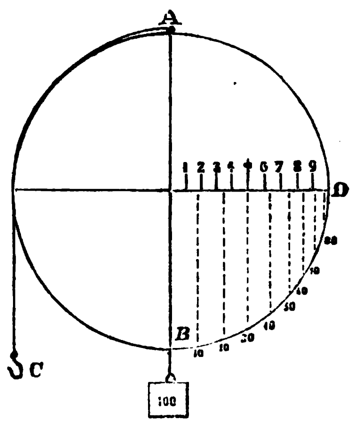
EXTRAORDINARY HYDRAULIC PERFORMANCE AT WOOLWICH DOCK-YARD.

A most interesting exhibition of hydraulic prowess recently took place in Her Majesty's Dock-yard at Woolwich, where there is a floating caissoon of large dimensions, from which it is occasionally necessary to remove the water. This has hitherto been accomplished by means of a pair of ten-inch pumps, fitted up in the best possible manner by an eminent engineering firm in London. These pumps have been worked by a party of thirty-two convicts, in two gangs of sixteen each, relieving each other at intervals of ten minutes, by which means the water has been pumped out in three hours and a half, the men at the end of that time being much distressed by their continued exertions. Mr. Walker (of Crooked-lane, King William-street,) having offered to raise the required quantity of water *in half the time*, with *half the number of hands*, by means of his new invented pump of which we gave an account in vol. xl. page 307, his proposal was made known to the Board of Admiralty, who imimmediately called upon Mr. Walker to fulfil his promise. Mr. Walker accordingly fitted up a pair of twelve-inch pumps worked by a rotary motion, which were completed and tried on the 20th of September last, under the superintendence of Captain Dennison, R.E., in the presence of Lord Adolphus Fitzclarence, Sir Francis Collier, Mr. Oliver Lang, and the principal authorities of the Dock-yard, who seemed to take a lively interest in the experiment, as the speedy emptying of the caissoon is to them a matter of great moment. The new pumps were manned by fourteen convicts (the same formerly employed in this work) in two gangs of seven each, relieving each other at intervals of fifteen minutes. In *one hour and fourteen minutes* the required task was accomplished, the men being in no way fatigued! The quantity of water raised was about 3,350 cubic feet, or 95 tons, lifted 13 feet high! The result of this trial created great astonishment among all present. Mr. Walker was warmly congratulated on having more than fulfilled his promise, and a full report of the trial was duly made to the Board.

By placing a second pair of Mr. Walker's improved pumps in the caissoon, it may, in case of emergency, be emptied in half an hour by 28 hands, although with the former pumps 32 men could not accomplish that task in less than three hours and a half. It is always very desirable to have the power of quickly emptying the caissoon, but under certain circumstances in the event of fire for instance) it is of the utmost importance to be able to do so.

POWER COMMUNICATED BY THE CONNECTING-ROD TO A CRANK.

Sir,—The recent discussion in your valuable pages on the theory of the crank, originating in the description of Lipscombe's patent substitute, has induced me to offer what appears to me a plain illustration of the power communicated by the connecting-rod to a crank at various parts of the stroke.



Let the above figure represent a circle described by a crank, whose radius is *unity*. Let there be a well-balanced wheel of the same diameter, from the lower periphery of which, at B, should be suspended a weight of 100 lbs., and at A, a cord attached, which being made to pass over one-fourth the circumference, should hang down at *c*, having a hook on which to suspend weights. (This cord and hook we must suppose to be balanced on the opposite side of the wheel.) Let there now be added weights at C, until the point of suspension at B is drawn 10° from the perpendicular,

and observe what weight produces the result; then add more weight, until B is withdrawn to 20°, and make a second observation; and so on at each 10 degrees, until B is raised to D, when it will be evident that B has been raised through a distance equal to the radius of the circle, and that the weights at C have descended through space equal to one-fourth of the circumference. It will, I think, further be evident that when the weight is at B, it will be sustained in its position without any weight at C; and that when at D, it will require sustaining by 100 lbs. suspended from C, both being at equal distances from the point of support; and that, if the average of these several observations be taken, it will represent an approximate average effect of a power equal to 100 lbs. descending through the arc D B, which will also represent the power as applied by a connecting-rod to a crank, whilst the weights, as applied at C, represent the mode of applying Lipscombe's substitute.

I now proceed to anticipate what I conceive would be the result of these experiments; for, be it observed, I have not tried them. I think that to withdraw the weight B 10 degrees from the perpendicular, you must apply at C a weight of 17,36 lbs. ($=100$ lbs. $\times$ sine of $\angle$) which would raise B ·0152

($=$ radius $\times$ versed sine of $\angle$),

and to withdraw B successively through each 10 degrees, additional weights must be added at C, as in the following table:—

Angle at which the weight B is suspended from the perpendicular.	Weight to be applied at C.	Additional height which B will be raised in parts of the radius.
Degrees.	lbs. lbs.	
0	00·	
10	17·36 = 17·36	·0152
20	+ 16·84 = 34·20	+ ·0451
30	+ 15·80 = 50·	+ ·0737
40	+ 14·28 = 64·28	+ ·1000
50	+ 12·32 = 76·60	+ ·1232
60	+ 10· 86·60	+ ·1428
70	+ 7·37 = 93 97	+ ·1580
80	+ 4·51 = 98·48	+ ·1684
90	+ 1·52 = 100·	+ ·1736
	Average 62·49	1·

If my supposition be correct, it would appear from this table that a power of 100 lbs., as applied by the crank of a steam-engine, descending through the space 1, or the radius, would be equivalent to a power of 62·49 lbs. descending through 1·57, or one-fourth the circumference. This, as I before said, is only an approximate result; but if the average weight at C, to balance B, through each degree of the quadrant, were taken, it would be found to be nearer 63·31 lbs., and 100 lbs. power $\times$ 1 space would be equal to 63·31 lbs. power $\times$ 1·57 space; so that Lipscombe's substitute, as compared with the crank, would be as six of one to half-a-dozen of the other.

I am, Sir,

Your obedient servant,

B. B.

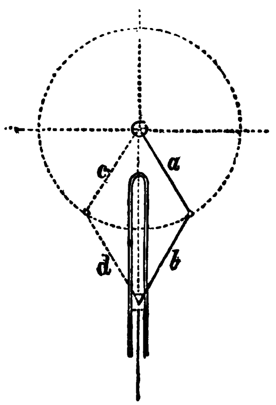
November 18, 1844.

CRANK CONNECTING-RODS.

Sir,—In the *Mechanics' Magazine* for Nov. 9, I promised two of your correspondents, "S. M." and "W. J.," to enter upon the subject of crank-connecting rods: I will now do so.

We will, if you please, Mr. Editor, commence at the fountain head. Let us suppose a crank to be 12 inches long; your readers will readily see, that a 6 inch connecting-rod would be totally unserviceable, because a complete stroke could not be made; we will therefore imagine the connecting-rod to be 12 inches long, that is, of precisely the *same length as the crank*. Now, we shall find, that when the connecting-rod is in a right line with the piston-rod, *it would transmit* the whole of the piston-rod pressure against the crank pin; whereas, at half stroke, that is, when the connecting-rod would be in a horizontal position, *it would not transmit* the slightest pressure against the crank pin: the piston-rod pressure at that instant would have the effect of causing the piston end of the connecting-rod to slip past the horizontal line, thereby preventing the completion of a stroke. Your readers will see that a connecting-rod, a very little longer than its crank, would effect a stroke, and become serviceable as part of an engine. But although a stroke cannot be made with the before-mentioned 12 inch connecting-rod, yet we can very easily arrive at the average per centage of pressure it would transmit during its first half stroke. Its average pressure transmitted during a half stroke,

would of course be but a very little less than would be transmitted by a serviceable connecting-rod a trifle longer. We have seen, that when the 12 inch connecting rod is in a right line with its piston-rod, it transmits against the crank pin *the whole* of the piston-rod *pressure;* whereas, when in a horizontal position, it transmits *no pressure* upon the crank pin; we shall therefore find the average per centage of piston-rod pressure transmitted against the crank, to be *only* 50 *per cent.;* the remaining 50 per cent. being wasted in forcing the piston head against its guides.



The above figure represents the position of the connecting-rod *a*, when transmitting against the crank pin its average pressure; the connecting-rod is at an angle of 45°. Those of your readers well acquainted with mechanics, will plainly see that the piston-rod pressure must give out half its force in the direction of the crank pin, and the other half at the same angle in an opposite direction, as shown by the dotted line *d;* they cannot fail to observe, that at that instant, only 50 per cent. of the piston-rod pressure is being exerted against the crank pin, the remaining 50 per cent. being wasted, in forcing the piston head against its guides. To prove this to be correct—suppose the guides to be taken away, and another crank, *c*, and another connecting-rod, *d*, attached to the piston as shown; is it not very clear, that as both connecting-rods are at the same angle with the piston-rod, the pressure given out by this latter would at that instant be equally divided between them, and that only 50 per cent. of the piston pressure is then being exerted against the crank *a?* Your readers will see at once, that the same pressure which would be exerted against the connecting-rod *d*, would be exerted by the piston head against its guides, if the connecting-rod *d* did not exist.

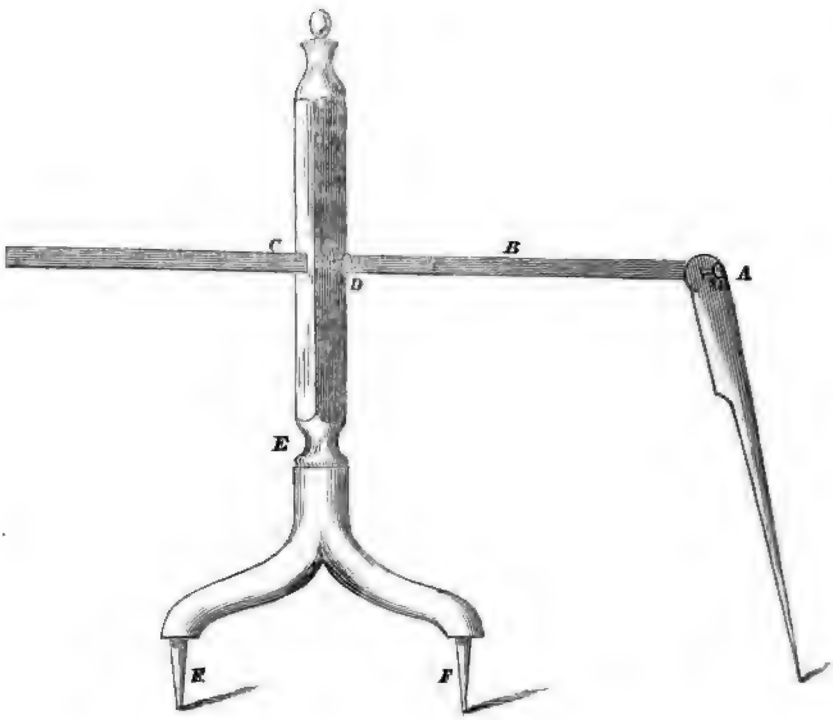
An average waste of 50 per cent. of piston-rod pressure is not the only loss sustained by a connecting-rod the same length as its crank during half a stroke; it is manifest, that were the piston then in motion, there would be great friction between the piston head and its guides, which will of course have to be overcome solely by that pressure which tends to turn the crank. Let us calculate what amount of power is requisite to overcome that friction. In my description of Lipscombe's patent substitute for the crank, I have shown that to produce a sliding motion requires a trifle more than half the amount of force exerted by the moving body upon a stationary one; therefore the friction between the piston head and guides will require half the force then being exerted against the crank pin to overcome it: we thus clearly see, that the then actual pressure exerted against the crank, were it in motion, would be only 25 per cent. of the piston-rod pressure; thereby showing an average waste of 75 per cent.

We shall find that the average obliquity of a connecting-rod, double the length of its crank, will be half the average obliquity of a connecting-rod the same length as its crank; consequently, the average waste by the longer connecting-rod will be only 37½ per cent.; and with a connecting-rod, four times the length of its crank, its average waste will be 18¾ per cent.

I dare say some of your readers will tell me that there are contrivances in most of our marine and stationary engines for the purpose of preventing that loss of power which would ensue by the oblique action of a connecting-rod. Let me tell them, that those very contrivances produce greater loss by oblique action than a moderately long connecting-rod, from the fact, that those contrivances consist of several moving parts; now the action of each of those parts is more or less oblique, and consequently, each wastes a certain portion of power, the sum total of which would exceed the loss occasioned

by a moderately long connecting-rod, and he who thinks otherwise I would recommend to obtain a thorough knowledge of the effects produced by obliquity of action, and then minutely investigate the action of the several parts of those contrivances. I am, Sir, your obedient servant, N.

HOLLAMBY'S COPYING INSTRUMENT.



Sir,—Although I am no artist, I have occasionally amused myself by copying drawings, prints and paintings, both in water colours and in oil; but, being unpractised, I found some of my figures rather out of proportion with the originals, and consequently, not exactly in their proper position. To remedy this defect I invented the instrument of which I have sent you a sketch, and which I have found to answer the purpose completely. I took the leg of a pair of brass compasses, which I have marked A, to which I affixed a steel slide, B, (I have several of these slides, from 6 to 18 inches in length, which I use according to the size of the picture). This slide is made to pass through a mortice in the upper part of the instrument, C, with a screw D, to fix it in its place. The upper part turns round in a socket at E, and the foot stands on two steel pins, ground rather blunt at the points, F F. The joint at A, and the socket at E, form a sort of universal joint, so that the point may be moved in any direction, while the foot remains stationary. The method of using the instrument is as follows:—set the foot, F F, on the bottom edge of the picture intended to be copied (a little to the left hand of the centre,) press it down till it has made sufficient impression, that you can set it at the same place again; set the point to any part of the

picture you wish, and by removing the instrument to a corresponding place on your paper or canvass, it will point out the place required with the greatest precision. I have made the body of the instrument of mahogany; but if it were manufactured by a mathematical instrument maker, it might be made entirely of metal, and greatly improved in appearance.

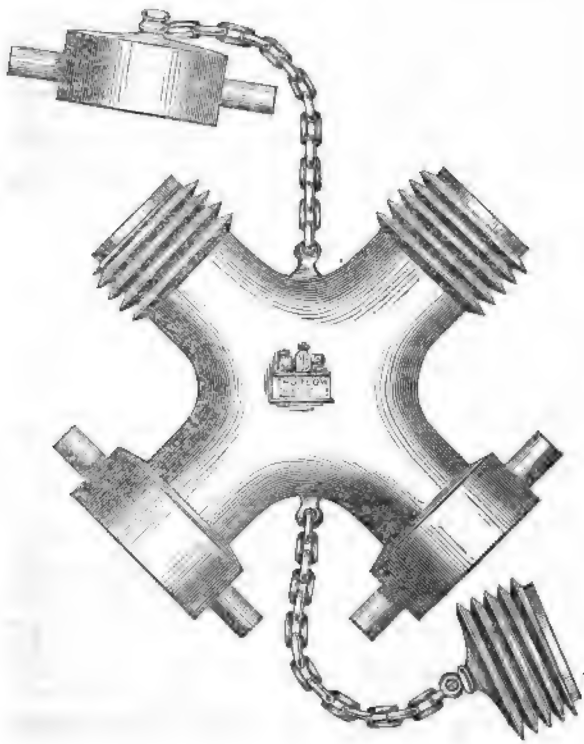
The builder avails himself of the assistance of the square, the level, and the plumb rule, and I do not see why we should despise any "helps" in attaining the end we have in view. I believe that any copyist may render his work more correct by taking a few of the principal points with this instrument than by trusting entirely to his eye. I submitted my instrument to the inspection of the late James Henry Capper, Esq., of Hailsham, and Richard Day, Esq., of Bexhill, both artists of some eminence, and they were pleased to express themselves satisfied with its utility.

I am, Sir, yours respectfully,

JOHN HOLLAMBY.

THE THURLOW BREECHIN.

[Registered under the Act for the Protection of Articles of Utility.]



The awful prevalence of incendiary fires in the counties of Suffolk and those adjoining, for some time past, have spread consternation among all classes of the inhabitants, but who would seem for the most part to have taken little interest in the question of the *causes*, and still less as to the best method of preventing or counteracting the *effects* of these agrarian outrages. One nobleman, however, has

set himself to work most assiduously to frustrate the machinations of the incendiary, by opposing the most prompt and powerful checks to the spread of fire. No reader of the daily papers can be unacquainted with the exertions which Lord Thurlow has for some time past been making to extinguish fires. His Lordship has organised and equipped a most efficient fire-brigade, and stationed two fire-engines on his estate (a *third* is now building), which for excellence of workmanship and the completeness of their equipment are altogether unrivalled.

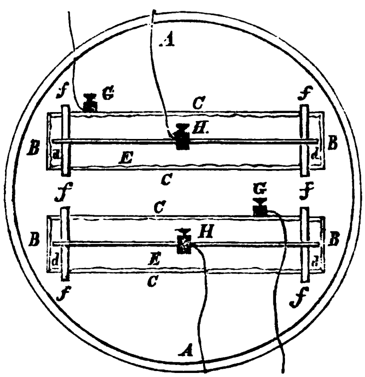
Several meritorious contrivances, long since recorded in the *Mechanics' Magazine*, but in which "*official*" eyes could perceive no advantages, have been employed by Lord Thurlow with unexampled success. Nor is this all; not only has his Lordship tested most impartially the neglected plans of others, but he has himself introduced some important improvements, one of which has led to these remarks. It is a somewhat remarkable circumstance that, if we except the invention of leather hose and the system of combating fires at close quarters, introduced by the Van der Heides* in 1672, we are not indebted to those whose *business* it is to extinguish fires, for any one invention connected with fire-extinguishing machinery. Beyond those just mentioned, there is not a single invention which contributes to the efficiency of our fire brigades, that has not originated with mechanical men, or amateur firemen.

Among the apparatus carried by most fire-engines of the present day, are what are technically called "Breechins;" they are of two kinds, the one being for the purpose of dividing the stream of water from one engine into two separate jets:† the other is for the purpose of uniting the streams of two engines into one large jet. By reference to the prefixed engraving it will be seen that our "noble fireman" has succeeded in combining in one and the self-same instrument the useful offices of the two; thereby reducing the number of articles to be carried, and also avoiding the delay and disappointment which sometimes arise from the wrong piece of apparatus being brought up. The former "breechin" had each three orifices; the "Thurlow Breechin" has four, any one of which can be instantly closed by a male or female cap provided for the purpose, so that the engine streams may be divided or combined at pleasure.

Lord Thurlow's crusade against fires has already been productive of great public benefit, not only as regards the valuable assistance in many cases so opportunely afforded by the Thurlow Brigade, but also by the spirit which his Lordship's example has infused into the regular fire-establishments of the adjacent districts.

Among those who have particularly distinguished themselves by their prompt and judicious exertions, Mr. Bird, agent for the Norwich Union Fire Office, in Bury Saint Edmunds, deserves especial notice. Within the last few days Mr. Bird's conduct at an incendiary fire was most favourably noticed in the local newspapers, who thought they could pass no higher encomium on his merits than by describing him as *the "Lord Thurlow of the occasion!"*

NEW ARRANGEMENT OF MR. SMEE'S BATTERY.



Sir,—There is in the present form of Mr. Smee's battery one great fault,—namely, that after a few days' continued use the wood becomes impregnated with acidulated water, and the vapour of the hydrogen evolved; occasioning consequently a great loss of power, as a connection is formed between the platinized silver and zink plates. The following arrange-

* John and Nicholas Van der Heide were superintendents of fire apparatus in Amsterdam.

† One of these is described and shown at page 206, vol. x.

ments to remedy these defects have been suggested to me by a member of the Mechanics' Institution.

A A is a piece of hard wood, covering the top of the jar; B B, two apertures cut in the cover about ½ an inch wide and 3 inches long; to the sides are fixed the platinized plates, C C, the opposite plates being connected by a band of metal, *d d*; E E, the zink plates passing between the two plates of platinized silver and supported by the glass rods, *f f f f*, by which insulation is entirely effected; at the bottom also, and midway up the zink plates, glass tubing is attached for the same purpose; G G, binding screws attached to the platinized plates; H, screws attached to the zink plates.

This arrangement admits of the battery working two electrotype troughs, or a large pair of plates, as one; a saving of a jar acid and zink plates, being effected, which to the electrotyper is of some consequence.

I am, Sir, yours,

W. M. S. H.

TEETH OF CLOCKWORK.

Sir,—It has often occurred to me that an improvement might be effected in the escapement of clocks, more especially of regulators, where correctness of performance is of greater importance than in other descriptions of time-keepers.

The teeth of the escape-wheel, according to the usual construction, slide off the surfaces of the pallets, to facilitate which, the teeth are lubricated with oil, which being spread over an extensive and exposed surface, becomes after a time mixed with dust, and thickens so much as to affect the rate sensibly; also forming a paste, which at length cuts a groove in the pallets, however hard they may be. The clockmaker would say, Why not send it every six months to be cleaned? I give the obvious answer, that the longer a clock can be made to perform its duty well without help, the more you increase its efficiency, to say nothing of the inconvenience of frequently losing its services. Now it seems to me that if hard steel rollers were substituted for the inclined planes of the pallets, that the oil on the teeth could be dispensed with, and in much smaller quantity transferred to the pivots of the rollers; the action of the escapement would be much more free; the rate would be less liable to alter; and if the rollers were carefully adjusted, the beat might still be dead.

Not being a clockmaker, I may not have expressed myself in strictly technical terms; but I merely throw out the hint in the hope that some of your practical readers may be induced to give an opinion upon the subject, and state whether rollers have ever been so applied; and if not, why the plan should not be acted upon.

I am, Sir,
Your humble servant,
EDWARD ROBSON.

Mile-end, November 22, 1844.

SUMMARY OF EXPERIMENTS MADE WITH SCREW-PROPELLERS AND ROTARY ENGINES FITTED TO MR. BEALE'S TRIAL BOAT, THE "PIGMY GIANT."

Sir,—A paper having the above heading appeared in your last Number; as it contains some misstatements, I trust you will insert the following reply in your next.

Your correspondent gives a table, *great part of which has been concocted by himself*, as the results do not accord with any experiments ever tried with the *Pigmy Giant*. The "calculated speed of propeller" given in it, does not accord with the pitch of the propeller we used when making those experiments of which your correspondent pretends to give a summary. What reliance is to be placed on the column headed "Water pumped in boiler in cubic feet per hour," will be seen on inspection; for it is there stated, that when exerting a calculated horse power of 2·39, there is "*pumped into the boiler*" nearly one-third of the quantity that is consumed when a calculated horse-power of 22·5 is being exerted. The column headed "Slip in miles per hour," too, *contains the slip of a propeller never submitted to any such experiment*. Without making more remarks on the Table, I leave the public to judge of the character of a man who so wilfully attempts to mislead them.

In all the experiments we have ever tried the pressure has been taken by the aid of a steam gauge; yet Mr. E. W. Baker informs us that "the weight of the valve and lever, together with Salter's spring balance (which will amply allow for friction and steam cooling in pipes, &c.), are not taken into account." His "personal observation" of the quantity of coke consumed is not correct; some experiments were tried in the presence of a scientific gentleman connected with the press; the consumption, when going well, did not exceed 60 lbs. per hour. Mr. Edward Whitney Baker talks of the "power requisite to propel 9 square feet of surface at a certain velocity." The form of the boat it appears (according to this

authority) has nothing whatever to do with the results obtained.

As the performances of the *Pigmy Giant* are so well-known, and have obtained the unqualified praise of many clever men, yourself included, it may be unnecessary to dwell upon the merits of the invention at present.

I am, Sir,
Your obedient servant,
JOHN BEALE.
East Greenwich, November 25, 1844.

[Having referred the preceding letter to Mr. Baker, he has favoured us with the following remarks upon it.—ED. M. M.]

Remarks.

If there be any error in the "Summary," the error rests with Mr. Beale himself, or those in his immediate employment, as the article was drawn up by me from two papers in the handwriting of one of his clerks, which were handed to me by Mr. Joshua Taylor Beale, *for the purpose of publication.* The first paper contained a detailed account of the construction of the *Pigmy Giant* and Blaxland's propeller. The second was a tabular statement of their performances, the first four columns of which are identical in their contents with the 1st, 2nd, 4th, and 7th columns of my "Summary." The columns added by me in the "Summary" are those headed, "Water pumped in boiler in cubic feet per minute," "Speed of piston in feet per hour," "*Calculated* horsepower," "*Calculated* speed of propeller," "Speed of boat through the water in miles per hour," "Slip (erroneously printed *strip*) in miles per hour;" but the intelligent reader will immediately perceive that these additional columns consist merely of arithmetical calculations, founded on the data furnished by the four original columns.

As regards the column headed "Water pumped in boiler," &c., it will be observed, that I do not state *evaporated.* The cause of the difference pointed out by Mr. Beale, I intended to explain in a future paper, and it is well known to him, although he has not chosen to say what it is. The cause is this,—when the steam is low the boiler is generally *priming*, (which can be proved by trying the upper gauge cock situated near the top of the boiler); as the pressure increases so the priming diminishes, and when high it entirely disappears; the pump (the plunger of which is $2\frac{1}{16}$ inches in diameter with $3\frac{1}{2}$ inch stroke) is then found to be barely sufficient to supply the boiler with the requisite quantity of water, the hand pump having often to be used, and the boiler being never blown out, while the boat is racing or going her best.

With respect to her consumption of fuel, will Mr. Beale be pleased to state what it is when exceeding 10 miles per hour? *Going well* is a vague term, and I am surprised at an engineer using it; certainly, it gives no idea of any determinate velocity, since *going well* with the *Pigmy Giant* might be *going bad* with some vessels. I may, however, state that I have been myself present when the coke was weighed by Mr. Beale's orders, and it was found that she consumed *six hundred* weight in *seven hours*, and when *going well* only a portion of the time—a fact which fully bears me out in my statements on this head.

E. W. BAKER.
November 25, 1844.

P.S. I am surprised that Mr. Beale in his criticisms on my paper did not discover the following rather important typographical error. The last sentence, which is in these terms, "A propeller of one semi-diameter with flat plates when tried in this vessel once reached a velocity of 6 miles per hour," should have run thus,—"A propeller of the *same* diameter and with flat plates when tried in this vessel *once* reached a velocity of 6 miles per hour."

THE ORTHOCHRONOGRAPH.

Sir,—I have seen in your last Number an account of the orthochronograph, by means of which correct time may be found. I feel some doubt as to the possibility of observing with sufficient accuracy to determine the time the solar ray intersects the curvilinear line described on the instrument. In the example stated, the time occupied by the solar ray passing is nearly 6 hours, or upwards of 21,000 seconds. The size of the instrument is not stated, but if we assume a moderate size, the space passed over in a second of time would be difficult to appreciate. However, an approximation to true time may be obtained. The idea is not new, as instruments something similar have been made.

Yours,
C. C. C. C.
Nov. 19, 1844.

WHY DOES INDIA RUBBER, AFTER BEING USED, NOT SOIL?

Sir,—Not having met in any work with an account elucidating the cause of the erasion of black-lead pencil marks by caoutchouc without, on its being used again, *soiling* the paper, I avail myself (being a subscriber) of

your excellent Magazine, through the medium of which I hope to gain some explanation on the subject. The first idea that struck me as to the cause was this,—that on the friction of paper by caoutchouc electricity is given off; and that as substances similarly electrified repel each other, so the carburet of iron, and the paper taking this condition, the former is dispersed, or driven off in innumerable particles, and the caoutchouc consequently retaining none of the extraneous matter, performs its duties for any length of time, without soiling the paper, &c. Linseed oil, by exposure to the atmosphere for some time, becomes hardened, and acquires all the properties of caoutchouc, and in all probability this theory would equally apply to it also.

I am, Sir,
Your obedient servant,
J. G. T.
An Amateur Chemist.

ENCOURAGEMENT TO INVENTORS.

From a notice in our advertising sheet, it will be seen that "a gentleman (name not given) being desirous of promoting the fine arts, and also of encouraging the authors of those useful inventions which add so much to the daily comforts of life," has most liberally offered on certain conditions (which may be known by application to the Secretary of the Society of Arts) a number of Rewards ranging in value from 3*l.* to 100*l.* for persons excelling in either of these departments. The prizes for inventions are as follows:—30*l.*, or a tea-urn of equal value, to the author of the most useful invention, whether patented or not, of the years 1842, 1843, and 1844: 20*l.*, or a silver waiter, to the second best; 15*l.*, or a gold medal, to the third best; 10*l.*, or a gold medal, to the fourth best; and 5*l.* to each of the authors of the next five most useful inventions of the same years."

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC., CAP. 65 FROM OCTOBER 23, TO NOVEMBER 25, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
October 23	299	John Mayow Hoskisson and Charles Hoskisson	Wilnecote, Warwickshire	Horse for making soles for drain tiles.
24	300	William Reynolds	Friendly-place, Mile-end	Design for the circles and arcs of circles of nautical and astronomical instruments.
25	301	Thomas Hy. Harris	15, Backmore-street, Clare Market	A portfolio.
29	302	Joseph and Edmund Ratcliff	St. Paul's-square, Birmingham	Bookholder.
30	303	B. and J. Raworth	The Arundel Forge, Sheffield.	Carriage spring bearings.
31	304	James Laurie	11, Gracechurch-st., London	Improved lamp burner.
Nov. 1	305	Job Allen	20, Bower-street, Commercial-road East	Anti-explosive alarm whistle.
2	306	Henry Brown	Solly Works, Sheffield	Carpenters' improved brace-head
,,	307	James Taylor	Great Grivendale	Bridle bit.
5	308	Joseph Wheeler	92, Tottenham Court-road	Improved pan for water closets.
8	309	Antoin Forrer	136, Regent-street, London	Card case.
,,	310	P. Howden	Penton-street, Pentonville	Name and sign plate.
11	311	Carpenter & Tildesley	Willenhall, Staffordshire	Improved lock spindle.
12	312	Alexander Dean	Birmingham	A drum for thrashing and bolting corn.
,,	313	William Cooper	20, St. Martin's-le-Grand	A multum-in-parvo seal.
,,	314	Joseph Fenn	Newgate-street	Spring adjusting plane.
14	315	Robert Bowman	Crane Foundry, Wolverhampton	The eubaron, or convenient weight.
,,	316	John Thomson Wilson	1, Lower Pale-place, Hammersmith-road	Improved smoke conductor.
15	317	Joshua Pariente	18, Coleman-street	A strap or belt of attachment (for articles of personal dress).
,,	318	Henry Hewetson	Cannon-street, London	Improved revolving cinder lifter
18	319	Sam. Whitfield, jun.	Oxford-street, Birmingham	Improved rack pulley.
19	320	James Grant	Vine-street, Westminster	Design for increasing the illuminating power of lamps.
25	321	Charles Millingen	15, White Lion-street, Norton Folgate	Parasol.

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN NOVEMBER.

THE USE of the BLOWPIPE in the Examination of Minerals, Ores, Furnace Products, and other Metallic Combinations. By Professor Charles Frederick Plattner, Assay Master at the Royal Frey

berg Smelting Works. Translated from the German, with Notes by James Sheridan Muspratt, Ph. D. of the University College and Giessen Laboratories. With a Preface, by Professor Liebig. 10s. 6d.

VESTIGES of the NATURAL HISTORY of CREATION. 7s. 6d.

SCIENTIFIC MEMOIRS, Part XIII. Translated from Foreign Journals and the Transactions of Foreign Academies. Edited by Richard Taylor, F.L.S., F.R.A.S. Mitscherlich, Reactions of Bodies by contact.—Plateau, Figure of a Liquid Mass freed from Gravity.—Rouillet, Solar Heat, Radiation, and Absorption.—Mohl, Structure of the Vegetable Cell.—Römer, Chalk Formation of Northern Germany.—Wartman, Colour Blindness. 6s.

PRACTICAL GEODESY; comprising Chain Surveying, the Use of Surveying Instruments, together with Levelling, and Trigonometrical, Mining, and Maritime Surveying. By Butler Williams, C.E., F.G.S. 12s. 6d.

ARITHMOLOGY; or, Theory of Common Arithmetic, fully proved without Algebra. By S. E. Caspersonn, M.B. 2s.

OUTLINES of CHEMISTRY, for the Use of Students. By William Gregory, M.D., Professor of Chemistry in the University of Edinburgh. Part I. Inorganic Chemistry.

FRESCO DECORATIONS and STUCCOES of the CHURCHES and PALACES in ITALY, during the 15th and 16th Centuries. Taken from the Works of the greatest Painters, never before engraved. With English Descriptions. By Lewis Gruner, and an Essay on the Arabesques by J. J. Hittorff.

RECENT ADVANCES in CHEMISTRY, and its Application to Agriculture; Report of Speeches delivered at a public dinner given to Professor Liebig in Glasgow, on Friday, Oct. 11, 1844. 1s.

EXEMPLA ORNAMENTORUM. The Book of Ornaments, embracing a display of Title-pages, Borders, Heads, Tail Pieces, Initials, Heraldic and other Devices. No. I. 4s.

THE ICE BOOK; being a Compendious and Concise History of everything connected with Ice, from its first introduction into Europe as an article of luxury, to the present time. With an Account of the Artificial Manner of producing pure and solid Ice; and a Collection of the most approved Recipes for making superior Water Ices and Ice Creams at a few minutes' notice. By Thomas Masters.

LIST OF ENGLISH PATENTS GRANTED BETWEEN OCTOBER 29, AND NOVEMBER 23, 1844.

George Fergusson Wilson, of Belmont, Vauxhall, gentleman, George Gwynne, of Prince's-street, Cavendish-square, gent., and James Pillans Wilson, of Belmont, aforesaid, gent., for improvements in the manufacture of night lights. October 29; six months.

Alexander Parks, of Birmingham, artist, for improvements in the manufacture of certain alloys, combinations of metals, and in depositing certain metals. October 29; six months.

George Robert D. Harcourt, of the Old Jewry, gent., for improvements in ascertaining and checking the number of checks or tickets which have been used, and marked, applicable for railway offices and other places. October 29; six months.

Thomas Squire, of Warrington, Lancaster, tanner, for improvements in tanning hides and skins. October 29; six months.

Thomas Fuller, of Manchester, engineer, for certain improvements in machinery, tools, or apparatus for turning, boring, and cutting metals and other substances. October 29; six months.

William Crofts, of Nottingham, lace manufacturer, and James Gibbons, of New Radford, machinist, for certain improvements in the manufacture of figured or ornamental lace or net of various textures. October 31; six months.

George Fergusson Wilson, of Belmont, Vauxhall, gent., George Gwynne, of Prince's-street, Cavendish-square, gent., and James Pillans Wilson, of Belmont, aforesaid, gent., for improvements in treating fatty and oily matters, and in the manufacture of candles. October 31; six months.

George Beadon, of Taunton, Somerset, gent., for improvements in life boats, or rafts, and in apparatus for raising or lowering the masts of vessels, which improvements in raising or lowering are applicable to other purposes. October 31; six months.

William Newman, of Birmingham, brass founder, for a certain improvement or improvements in window blinds. November 2; six months.

Charles Smith, of Newcastle-street, Strand, gent., for new and improved methods in the construction and application of a variety of cooking, culinary, and domestic articles and utensils, some of which are applicable to cleaning, and a variety of similar useful purposes. November 2; six months.

Jean Baptiste Manignet, of Sabloniere Hotel, Leicester-square, gent., for improvements in doubling, twisting, and reeling silk, cotton, and other substances. November 2; six months.

Thomas Unsworth, of Derby, silk weaver, for an improved manufacture of elastic fabric. November 2; six months.

Joseph Thomas, of Finch-lane, publisher, for a new and improved tube. (Being a communication.) November 5; six months.

Henry Atkins, of Nottingham, lace manufacturer, for certain improvements in the manufacture of net lace. November 5; six months.

John Groom, of Oldham, Lancaster, for certain improvements in machinery, or apparatus for preparing, slubbing, and roving cotton, wool, and other fibrous substances. November 7; six months.

Stephen Geary, of Hamilton-place, New-road, engineer, for certain improvements in the machinery, apparatus, and arrangements for the supply and distribution of water for public and private uses, but more particularly in cases of fire. November 7; six months.

Henry Borriskill Taylor, of Piccadilly, lamp manufacturer, for improvements in apparatus for transmitting light from lamp and other burners. November 7; six months.

Daniel Chandler Hewitt, of Hanover-street, Hanover-square, musical instrument maker, for improvements in certain stringed and wind musical instruments. November 9; six months.

David Auld, engineer, of Dalmarnock-road, and Andrew Auld, engineer, of West-street, Tradestown, Glasgow, for an improved method or methods of regulating the pressure and generation of steam in steam boilers and generators. November 9; six months.

William Prosser, junior, of Windsor-terrace' Pimlico, gent., for improvements in the construction of roads, and in carriages to run thereon. November 9; six months.

Richard Harris, the elder, of Leicester, manufacturer, for improvements in machinery employed in the manufacture of looped fabrics. November 9; six months.

Charles Derosne, of Rue des Batailles Chaillot, near Paris, gent., for certain improvements in extracting sugar or syrups from cane juice and other substances containing sugar, and in refining sugar and syrups, being an extension for the term of six years from the expiration of the original letters patent. November 9.

John Dearman Dunnicliff, of Nottingham, lace manufacturer, William Crofts, of New Lenton, Nottingham, lace manufacturer, and John Woodhouse Bagley, of New Radford, Nottingham, mechanic, for certain improvements in the manufacture of lace and other weavings. November 13; six months.

Mark Freeman, of Sutton, Esq., for improvements in working, or dressing the surface of stone. November 14; six months.

Frederick Steiner, of Hyndburn Cottage, Lancas-

ter, turkey red dyer, for a new colouring matter to be used in dyeing certain colours on cotton, woollen, silk, and linen fabrics. November 14; six months.

William North, of Stangate, slater, for improvements in covering roofs and flats with slate. November 14; six months.

Isaac Farrell, of Great Brunswick-street, Dublin, architect, for certain improvements in machinery, whereby carriages may be impelled on railways and tramways, by means of stationary engines, or other power, including certain apparatus connected with the carriages to run on the same. November 14; six months.

Francis Watten, of Finsbury-square, merchant, for improvements in preventing incrustation in steam boilers and steam generators. November 16; six months.

Joseph Maudslay, of Lambeth, engineer, for certain improvements in steam engines. November 16; six months.

Francis Higginson, of Rochester, lieutenant in her Majesty's Navy, and Edward Robert Coles, of Rochester, aforesaid, merchant, for certain improvements in the construction of buildings generally. November 21; six months.

David Metcalf, of Leeds, dyer, for a mode of manufacturing or preparing a new vegetable preparation applicable to dyeing blue and other colours. November 21; six months.

John Spencer, of the Phœnix Iron Works, West Bromwich, Stafford, for improvements in manufacturing, or preparing plates of iron, or other metal, for roofing, and other purposes, to which the same may be applied. November 23; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22ND OCTOBER, TO THE 22ND NOVEMBER, 1844.

Josiah Davies, of Birmingham, Warwick, engineer, for certain improvements in steam engines, part of which improvements are applicable to impelling wheel carriages. October 26.

Frederick Steiner, of Hyndburn Cottage, near Accrington, Lancaster, turkey red dyer, for a new colouring matter to be used in dyeing certain colours, on cotton, woollen, silk, and linen fabrics. October 30.

Moses Poole, gentleman, London, for improvements in machinery for emptying privies and cess pools. (Being a communication from abroad.) October 30.

Thomas Brown Jordan, of College-road, Pimlico, Middlesex, mathematical divider, for improvements in the manufacture of blocks, or surfaces for surface printing, stamping, embossing, and moulding. November 11.

George Fergusson Wilson, of Belmont, Vauxhall, Surry, gentleman, George Gwynne, of Prince's-street, Cavendish-square, Middlesex, gentleman, and James Pillans Wilson, of Belmont, aforesaid, gentleman, for improvements in treating fatty and oily matters, and in the manufacture of candles and night lights. November 11.

James Pilbrow, of Tottenham, Middlesex, civil engineer, for certain improvements in propelling carriages on railways and common roads, and vessels on rivers and canals. November 13.

Sir George Steuart Mackenzie, of Coul, Ross, baronet, for an improvement or improvements in the manufacture of paper, more particularly for the purpose of writing and copying writings, and machinery for effecting the same, also the manufacture of a fluid or fluids to be used with the improved paper in the manner of ink. November 15.

William Badington, junior, of Birmingham, Warwick, manufacturer, for improvements in the construction of furnaces. November 18.

John Dearman Dunnicliff, of Nottingham, lace manufacturer, William Crofts, of New Lenton, Nottingham, lace manufacturer, and John Woodhouse Bagley, of New Radford, Nottingham, mechanic, for certain improvements in the manufacture of lace and other weavings. November 18.

Felix Moreau, of Ghent, in the kingdom of Belgium, engineer, for improvements in the manufacture of cork and other similar articles made of cork wood, or other materials, and the application of certain of the refuse matters to various useful purposes for which they have never heretofore been employed. November 19.

John Groom, of Oldham, Lancaster, mechanic, for certain improvements in machinery or apparatus for preparing, slubbing, and roving cotton, wool and other fibrous materials. November 22.

LIST OF PATENTS GRANTED FOR IRELAND FROM THE 24TH OF JUNE TO THE 24TH OF OCTOBER, 1844.

John M'Bride, manager of the Nursery spinning and weaving mills, Hutcheson Town, Glasgow, Scotland, for certain improvements in the machinery and apparatus for weaving by hand, steam, or other power. Sealed June 26, 1844.

Isaac Farrel, of 199, Great Brunswick-street, Dublin, architect, for certain improvements in machinery, whereby carriages may be impelled on railways and trainways, by means of stationary engines or other power, including certain apparatus connected with the carriages, to run on saud. June 26.

Thomas Edmundson, of Manchester, Lancaster, mechanist, for certain improvements in printing presses. June 27.

John Wilkie, of Glasgow, mechanic, for certain improvements in machinery or apparatus for working wood into the various forms required, &c., &c. June 29.

John Stevelley, of Belfast, Antrim, Professor of Natural Philosophy, for improvements in steam-engines. June 29.

Edward Cobbold, of Melford, Suffolk, clerk, M.A., for improvements in the preparation of peat, rendering it applicable to several useful purposes, particularly for fuel. July 1.

John Lawson, of Leeds, York, engineer, and Thomas Robinson, of Leeds, aforesaid, flax-dresser, for invention for cleaning flax, wool, silk, and other fibrous substances. July 1.

John Taylor, of Duke-street, Adelphi, Middlesex, gentleman, for invention of certain new mechanical combinations, by means of which economy of power and of fuel are obtained in the use of the steam-engine. July 4.

Edmund Morewood, of Thornbridge, Derby, merchant, and George Rogers, of Stearndale, Derby, gentleman, for improvements in coating iron with other metals. July 4.

William Wright, of Duke-street, St. James's, Middlesex, surgeon, for certain improvements in rendering leather skins or hides impervious to wet, more flexible, and more durable. July 6.

William Henry Phillips, of Bloomsbury-square, Middlesex, engineer, for improvements in the means and apparatus for subduing and extinguishing fire, and saving life and property; and in obtaining and applying motive power; and improvements in propelling. July 26.

George Miller Clarke, of Albany-street, Regent's-park, Middlesex, tallow-chandler, for improvements in night lighting, and in apparatus used therewith. July 31st.

George Bell, of Pembroke-road, Dublin, merchant, for certain improvements in a machine or machines which facilitate the drying of malt, grain, and all kinds of seeds. August 7.

George Gwynne, of Prince's-street, Cavendish-square, Middlesex, gentleman, and George Fergusson Wilson, of Belmont, Vauxhall, Surrey, gentle-

man, for improvements in treating certain fatty or oily matters, and in the manufacture of candles and soap. August 16.

Jaques Bidault, of Paris, merchant, for improvements in applying heat for generating steam, and for other purposes, which improvements may be used for obtaining power. August 16.

Charles William Graham, of King's Arms Yard, London, merchant, for improvements in manufacturing pathological, anatomical, zoological, geological, botanical, and mineralogical representations in relief; and in arranging them for use; being a communication. August 16.

John George Bodmer, of Manchester, Lancaster, engineer, for certain improvements in grates, furnaces, and boilers; and also in manufacturing and working iron and other metals, and in machinery connected therewith. August 3.

Thomas Southall, of Kidderminster, Worcester, druggist, and Charles Crudginton, of the same place, banker, for improvements in the manufacture of iron and steel. August 26.

Wilton George Turner, of Gateshead, Durham, doctor in philosophy, for the manufacturing of salts of ammonia and cyanogen from a substance never before applied to that purpose. August 26.

Joseph Martin Kronheim, of Castle-street, High Holborn, London, engraver, for improvements in stereotyping. (Being a communication.) August 30.

James Fenton, of Manchester, Lancaster, engineer, for an improved combination or alloy, or improved combinations or alloys of metals, applicable to various purposes for which brass and copper are usually employed in the construction of machinery. (Being a communication from a foreigner residing abroad, and improvements made by himself.) September 20.

Robert Davison, of Brick-lane, Middlesex, civil engineer, and William Symington, of East Smithfield, in the said county, Esq., civil engineer, for a method or methods of drying, seasoning, purifying, and hardening wood and other articles, either in a manufactured or unmanufactured state; parts of which are applicable to the preparation and desiccation of animal, vegetable, and mineral substances. September 24.

Peter Ward, of Albury, Salop and Worcester, late of Westbromwich, Stafford, practical chemist, for an improvement in combining matters for washing and cleansing. October 15.

George Augustus Kollmann, of the German Chapel, St. James's Palace, Middlesex, gentleman, for certain improvements in railways, and locomotive and other carriages. October 15.

NOTES AND NOTICES.

Potato Sugar.—The growers of potatoes in the British kingdom are likely to be benefited by the exertions of the home sugar manufacturers, who are now determined to purchase all that comes within their reach. At the manufactory of potato sugar, at Stratford, in Essex, and other places, we understand that the "fruit of the earth" (potato) will be taken in any quantity, and at a fair price. We have no doubt that the juice of the cane is superior to the meal of the potato, but we have positive proof that the potato can make up in quantity what is deficient in quality; and as no one can question the nutriment in the potato, we do not see why potato sugar should not be as advantageous to the tea or coffee table as the potato is to the dinner table; be this as it may, we have it on good authority, that three tons of the raw material will produce one ton of the manufactured article, and consequently the British manufacturer can successfully compete with the foreign and colonial producer, and pay the same duty as that which is levied on the sugar imported from the Colonies.—*Price Current.*

"Short" Iron.—"Repudiating all intention of entering into the comparative merits of Scotch and English iron, or hot and cold-blast, I would merely venture to record my firm and decided opinion, that, in particular cases—as in the instance at Oldham—cast-iron should not be trusted. It is always crystalline in its texture, and, therefore, more or less brittle, according to the circumstances under which it is prepared, in reference to the character of the ore, the flux, ratio of cooling, and admixture of extraneous matters. A specimen of native iron, somewhere in my possession, is fibrous in structure. In the case of axles, and the like, rods or plates of iron should be twisted together, and united by welding. It is in this way, I am informed, that the famous 'Damascus blades' are made, and that their vast superiority is not merely connected with the individual character of the *wootz*—though that, too, may contribute something to their value. Many specimens of fine Swedish steel, I conceive, may vie with ordinary Indian *wootz*. I believe, too, that the pliancy and other properties of the Spanish 'toledo' are also assignable to the mode of working the steel, and twisting the plates or rods together. The sword presented by Mr. Sowerby to the Emperor Alexander, and manufactured from the meteoric iron of Siberia, was, if I recollect aright, very flexible and elastic, arising, no doubt, from the fibrous structure of the material. I merely wish to recommend the old adage—'A threefold cord is not quickly broken'—to the case of working in iron. The cohesive strength of the individual film may be feeble, but the aggregate of numbers, twisted together, as in the rope, may defy a powerful shock."—*Professor Murray.—Mining Journal.*

Caution as to the use of Guano.—"I wish to call your attention to a very prevalent error in the use of guano as a manure: in the districts where alkaline dressings are used, that is, where they manure with lime, wood-ashes, &c., farmers frequently mix those substances with guano before spreading them upon the land, reasoning thus—that if lime is good, therefore they will be the better mixed, whereas, nothing can be more erroneous; the guano is spoiled by it, and the lime is injured, because the principal fertilizing ingredient of the guano is its nitrogen, a great part of which exists in it as ammonia; and this flies off, producing a very disagreeable smell as soon as lime or any other alkali is added to that of guano, leaving the manure so far impoverished, while the acid which retained the ammonia in the guano, goes to the lime, and reduces its value as a manure."—*Mr. W. Herapath, Bristol.*

Erratum.—Page 360, 1st col., 4th line, *for* "glass U, the tube C," *read* "glass U-tube C."

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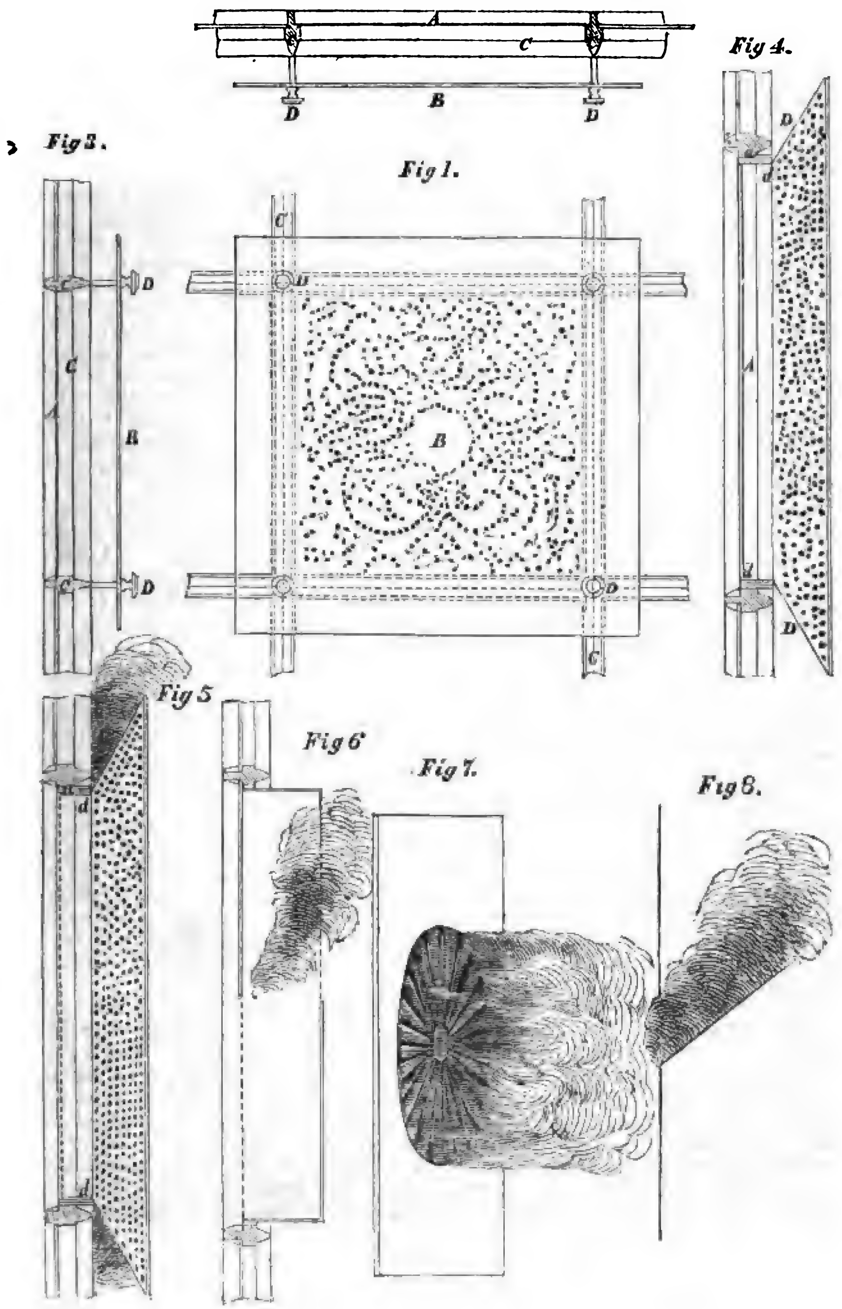
DR. GUY'S SYSTEM OF VENTILATION.



VENTILATION. DR. GUY'S PATENT.

[Sealed May 25, 1844; Specified November 25, 1844.]

Men are beginning to understand the full amount of the injury which they are suffering and inflicting by the neglect of ventilation, and men of science are turning their attention to the best means of effecting it. This growing sense of the want of fresh air, on the one hand, and this increased attention to the means of supplying it, on the other, must lead to very important results. Now-a-days, no new building can be erected without some provision for ventilation, and ere long, it will seem barbarous to allow our old ones to stand unimproved in this respect. The necessity of improvement once fully admitted, inventions will not fail to multiply till some unexceptionable plan shall be devised.

In the case of new buildings there is free scope for inventions of all sorts. Pumps, fans, and screws—furnaces, steam-engines, and tall chimneys—may freely compete for favour, and provided the expense be no obstacle, each will be adopted with a certain measure of success. All these inventions are well enough in their way, and if we use fire and force enough they must needs be successful. Sensitive people will complain of draughts, especially if cold air be forcibly drawn or pumped under their feet, but no one can doubt that legislators and lawyers may have air enough if they will only pay for it. But the great question is, what are the poor people to do who never touch the strings of the national purse, or even their richer brethren, who cannot afford steam-engines and tall chimneys, and the costly alternatives of pumps, screws, or fans? Are they to be debarred from the use of fresh air altogether? Must the labouring class still be stewed and poisoned, and the fashionable world be reduced to the sad necessity of foregoing their pleasures or continuing to regale their friends and themselves on foul air?

To be serious on a serious matter: there is no method of ventilation which can come into general favour, and meet the wants of all classes, but one that is cheap both in its first application and in its continued use. In at least nine hundred and ninety-nine cases in a thousand—in the bed-rooms of the rich, in the rooms of the poor, in workshops, and shops, in all existing buildings which do not admit of extensive alterations, such as theatres, assembly rooms, churches, &c.—all chemical and mechanical methods are quite out of the question, and *spontaneous* ventilation (as it is called) is the only method which can be adopted.

Now spontaneous ventilation is open to two classes of objections, one of which cannot, and the other can, be removed. The objections that cannot be altogether removed are these: As spontaneous ventilation must depend in a great degree on the movements of the external air, it will be imperfect when the air is still; and, on the other hand, if provision be made for a free ventilation in ordinary states of the atmosphere, there will be too much air during high winds, a degree of ventilation which will be objectionable in the depth of winter. In reference to these two objections, the question arises—is there any great harm in a little extra ventilation from time to time, and is it expedient, even in the legislature itself, to provide at an enormous expense, for the evils of the dog-days? A third query might be added. May it not be desirable in this variable climate of ours to expose ourselves in-doors, in a less degree, to those variations in the state of the air which we are sure to meet with out of doors?

The difficulty, then, of guarding against the two extremes of a deficient and imperfect supply of air in opposite states of weather are the two objections to spontaneous ventilation. As to the objection, that enough air cannot be admitted by this means, there is no foundation for it. Make openings enough in your walls or windows, and, above all, keep your chimneys open, and multiply them if necessary, and you will have no difficulty in supplying air to the most crowded buildings in London.

But then the draught! Ay, the draught! There, is the great objection to spontaneous ventilation. How is that to be overcome? There is not a man in all Britain, be he rich or poor, educated or uneducated, learned in words or in things, who has not a mortal horror of a draught. He will inhale poison and breathe the breath of other people with as much enjoyment as the Russian boor

will eat tallow or drink train-oil; but direct a little fresh air upon him, and he is frightened out of his wits. Catarrhs, pleurisies, and consumptions appear in terrible array before him, and he shrinks and shivers, and looks as much like a martyr as if it were not all his own doing. If he must needs expose himself in a heated room to a foul combination of poisons, the produce of the combustion of men and gases, what can he expect but that he should feel a draught, and fear it?

Hitherto, neither forcible nor spontaneous ventilation has been free from this objection. Some of our great authorities, aware, probably, of the ease with which a cold may be caught by the feet, have drawn and pumped cold air through the floors till our lawyers and legislators have winced again, and the poor reporters have been obliged to enter their strong and unanimous protest against the barbarity. It is well for one of our learned pundits that he does not practise medicine, or he might be exposed to shrewd suspicions.

But as there is such a wide-spread objection to draughts, it is quite clear that no plea of ventilation can be worth much or hope for general acceptance which does not aim at obviating them. This desideratum has not yet been obtained, either by mechanical or by spontaneous ventilation. As Dr. Guy's method is of the latter kind, we shall confine ourselves to the inventions in common use for facilitating the spontaneous admission of air into buildings. They all aim at the prevention of draught, but they all fail.

The revolving ventilator is the first which we shall notice. Now, of all the odd inventions, this is the oddest; of all the unphilosophical contrivances in use the most unphilosophical; and yet the thing is used by thousands and tens of thousands. In spite of the noise it makes when in action, its unsightly appearance when at rest, its liability to get out of order, the difficulty of keeping it clean, and the little obstacle it presents to the entrance of the smoke and dust of large towns, it is still extensively employed. Why it was ever used no one can make out, for it not only does not prevent a draught, but the faster it revolves the more draught it produces. Any one who doubts the truth of this assertion may soon convince himself by directing a little smoke against it.

The *hopper* is another invention intended to prevent a draught, which it accomplishes very imperfectly, and whether it was intended for that purpose or not, most successful in disfiguring a building. It is better than the revolving ventilator, inasmuch as it does not increase a draught, though it does little to prevent it, and it makes no noise.

The most elegant invention of modern times is a *combination*, so to speak, of hoppers—*the glass louvres*. The chief objections to this invention are, that it is very expensive, and that it does not prevent a draught, though it slightly modifies it. Any one who will stand near it when it is open, will convince himself of the truth of this latter assertion, which is confirmed by the very few that will be found open of the many that are to be seen in the streets of London.

We now come to Dr. Guy's invention, which also lays claim to the important property of admitting air without a draught. The means by which he effects this are very simple. He takes out a pane of glass, or makes an opening in a wall or door, and he fills this with a combination of a perforated plate or plates of metal, and a *parallel* shield. The opening by which the air enters is filled with the perforated plate, and behind, and parallel to this, a shield is placed. The shield and perforated plate are either separate, or joined by means of a second perforated plate.

Figs. 1, 2, and 3, of the accompanying plate represent this invention in one of its simplest forms; fig. 1 being a back elevation, fig. 2 a horizontal section, and fig. 3 a vertical section. A is the plate of perforated metal inserted into a square of a window-frame (the usual pane of glass being removed); B is the shield of glass fixed behind and parallel to the perforated plate, which is kept in its place by means of screws, D D, passed through the shields into the astragals C C of the window-frame.

Instead of the space between the perforated plate and shield being left quite open, it may be filled up with a perforated plate in the manner shown in fig. 4, which is a sectional elevation of a circular ventilator. A is the outer perforated plate, as before, only that it is provided

with a solid or unperforated rim, *a a*. D is an additional perforated plate, with a rim *d d*, which fits tightly within the rim *a a* of the outer plate—this additional plate being inclined inwards as shown. The shield B is made fast to the outer circumference of the additional plate D; and the screws used in figs. 1, 2, and 3 are thus dispensed with. Or two plates may be used, as represented in fig. 6, each of which is half entire, and half perforated; that is to say, the upper half of the outer plate may be entire, and the lower perforated, and the upper part of the inner plate perforated and the lower entire, and the two plates may be united at the edges by rims or flanges in the manner shown.

Such, then, is the principle of the invention. The column of air is first broken up by entering through a perforated plate; it is then scattered by the shield, so that its direction is entirely altered; and lastly, it is admitted into the apartment through the openings in a second perforated plate, by which it is again minutely subdivided. By this means, as we have had an opportunity of witnessing experimentally, the draught is entirely prevented, the current of air being confined, as shown in fig. 5, to the narrow spaces between the window and the plane of the shield, or thrown, as in fig. 6, towards the ceiling of the apartment. The air is so altered in its direction, and so completely deprived of its force, that the invention may be used in bed-rooms, and by persons most susceptible of draughts, with perfect safety. Figs. 7 and 8 represent the course of the air as it passes through the revolving ventilators, and as altered by the common hopper, or other oblique arrangements.

The most striking advantage which Dr. Guy's invention possesses over the hopper, and its recent modification, is that of breaking up the column of air at the same time that it entirely alters its direction. When the air is allowed to enter an apartment in a body, though its course be changed, it will be found to descend again, so as to produce a draught. This can only be prevented by such an arrangement as that which Dr. Guy has adopted.

The combination of the perforated plate or plates with the parallel shield obviously admits of many modifications. Several of these are claimed in Dr. Guy's specification. In the case of churches and large buildings, the shield is held in its place by screws, and is intended to assume a great variety of ornamental forms, adapted to the style of the architecture. When the ventilator is introduced into the walls of a building, it is made in the form of a box of uniform dimensions throughout, the air being guided from the outer perforated plate to the shield by an oblique partition; and if provision is to be made for occasional ventilation only, a movable form is employed, which may be placed above the upper, or below the under sash, in the manner of an Æolian harp. Entire windows are also constructed on the same principle. A double window, economising heat and admitting air at the same time, is not the least useful form which the invention assumes.

The inhabitants of cellars and places below the level of the road-way have not escaped Dr. Guy's attention, as they are but too apt to do that of the more fortunate tenants of more airy apartments. As rooms so situated derive little benefit from the movements of the air, the following form of ventilator is employed to bring the air down to them. In fig. 9, E is the apartment; C, an air passage, or vent, formed in the wall D above the ground level, having a perforated plate, or open piece of brickwork, A, in the side fronting the external atmosphere, and terminating at bottom a little way below the roof, this lower opening being protected by a shield B, which serves to disperse the air over the apartment. No specific arrangement is included in the patent for the exit of air. The open chimney filled with a chimney-board, which is provided with a shield to prevent downward currents, and, if necessary, a valve, to regulate the draught, is the best and simplest exit for the air. Such a chimney-board is included in the specification.

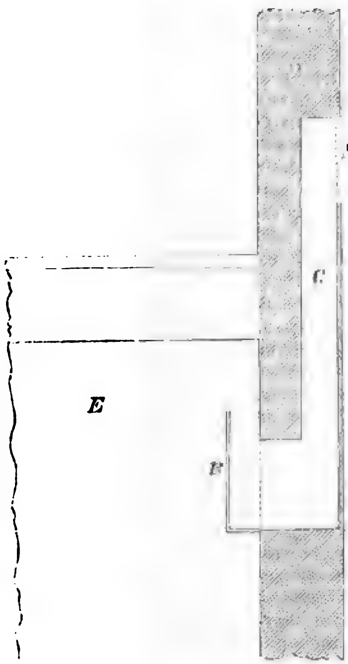
In the case of new buildings, and wherever it is thought desirable to bring a supply of air from above, Dr. Guy makes use of some simple arrangements for producing downward currents, the entrance into the apartment being provided with a shield for the distribution of the air.

In the case of ships, Dr. Guy em-

ploys a bent tube, with a floating valve to prevent the admission of water into the vessel, but not interfering with the entrance of the air.

By far the most important of the inventions included in Dr. Guy's specification is undoubtedly the simple window or wall ventilator in its several forms. We shall, therefore, conclude this notice by recurring to the advantages to which it lays claim.

Fig. 9.



The great advantage, without which all the others would be of little comparative value, is the prevention of draught, which is effected in two ways; first, by the shield, which breaks the force of the air, and turns the current in a safe direction; and secondly, by the perforated plate or plates, by means of which the force of the air is still further weakened, and the stream more minutely subdivided. In this way those downward currents that form so strong an objection to all ventilators which admit the air in a body, even though they somewhat modify its direction, are effectually guarded against. This, then, is the first and chief advantage of the invention. Its other recommendations may be enumerated as follows:—

1. The aperture by which the air is admitted is filled in such a manner, that the line of the wall or window is unbroken. 2. The perforated plate or plates, exclude a large proportion of the particles of soot or dust which float in the atmosphere of large towns. 3. The ventilators are of such a form as to admit of the insertion of sieves of muslin or other similar material for the more complete arrest of particles of smoke and dust. 4. They can be easily provided with valves to regulate the admission of air. 5. The shield may assume any ornamental form, and from its parallel position in relation to the wall or window may be made to conduce to architectural effect. 6. It may be so made and fixed as to be easily removed and cleaned. 7. From the material of which it consists, it may obviously be manufactured at a cheap rate, so as to suit the views of those to whom ventilation is a great object.

All these minor recommendations, even if they were increased two-fold, would have little weight as compared to the effectual prevention of draughts. That Dr. Guy's invention is perfectly successful in this respect, where the difference between the temperature of the external air and the apartment to be ventilated is not considerable, we have ourselves had an opportunity of ascertaining. But where the temperature of an apartment is allowed to rise to 70° or higher, by overcrowding or overheating, while the external air is below the freezing point, it is scarcely to be expected that cold air should be admitted, in whatever quantity or by whatever device, without producing a sensation of cold. You may throw the air towards the ceiling, or allow it to spend its force in the narrow space between the wall or window and the plane of the shield, and break it up into a thousand streams, but it will communicate its coldness to the neighbouring strata of air, and possibly descend as a fine shower upon the heads of the inmates. How far the invention may succeed in such extreme cases, experience only can show. But such extreme cases ought never to

exist. The constant use of ventilators of sufficient size and number will render the future occurrence of such cases impossible. The existence of any perceptible draught proves that the arrangements for the admission of air are incomplete, and, if, after all, that can be done to obviate this great inconvenience, draughts shall still be found to exist, the question must suggest itself to every reflecting mind, whether foul air or a slight draught is most to be feared. We, Englishmen, have practically answered this question by clinging to the open fireplace with draughts from every key-hole and crevice, rather than embrace the unwholesome alternative of the stove, with its stagnant air and most seductive economy.

We trust that Messrs. Cottam and Hallen in whose hands Dr. Guy has placed his patent, will use their best endeavours to supply the more simple forms of the invention at a small cost, and that they will furnish the public with one form as a cheap substitute for the revolving ventilators, on the inefficiency of which we have had occasion to comment.

WALKER'S PUMP—SUPERIORITY OF CRANK-WORKED ENGINES.

Sir,—The recent hydraulic performance of Mr. Walker at Woolwich Dockyard, as described at page 373 of your last Number, may well be styled extraordinary; and many persons will doubtless ask, how it happens that Mr. Walker should have surpassed his fellows in an art that has engaged the attention of the most expert mechanicians ever since the days of Ctesibes? To me there appears to have been a threefold reason for Mr. Walker's success. In the first place, he has, by a skilful and judicious arrangement of his pumps, reduced the lift fully one-fifth, by getting rid of the water at a lower level than heretofore. Secondly, by the peculiar construction of his (*patent*) valves, he obtained the freest possible waterway, with certainty of action, and the impossibility of loss by backwater. Finally, the whole arrangement was crowned by a judicious application of the power to its work, through the medium of the *winch*. Mr. Ewbank, in his interesting work on Hydraulic Machinery, suggests the working of fire-engines by means of the *winch*, apparently ignorant that this mode of working has prevailed in our floating fire-engines for nearly a century. He says (p. 338), "if the pumps were worked by long cranks on each side, the firemen could not only perform *fifty per cent.* more labour, but they could do it with *less exertion*, and consequently *endure it longer*." Mr. Walker's success with the crank-worked pumps goes far to justify Ewbank's proposition, and confirms the principle laid down by our most celebrated experimentalists in this branch of mechanics. The winch has generally been considered the most effective medium for the application of manual power; there have, however, been dissentients from this doctrine. When the London Fire Establishment were about to build a new floating engine, they took considerable pains to avoid adopting Mr. Baddeley's well-known *improvements* in these machines; at last they found a plausible excuse in the asserted loss of power in the crank; they thereupon threw the crank overboard, and adopted the alternating motion, as in land engines. The sanction of Mr. Walker, President of the Institution of Civil Engineers, was obtained for this preference; but I think it more than probable that he was not fairly used in this matter, and that the question propounded to him was so shaped as to elicit the particular answer that was required to support and justify a foregone conclusion. Be this as it may, the result is just what might have been expected, and our modern floating engines are a libel on the science of the day—machines less remarkable for their power than for their unwieldiness and unfitness for the intended purpose. Altogether destitute of the means of rapid transit, great delay has in almost every case arisen in getting them into action, although several conflagrations requiring their services have broken out within sight of their moorings. As regards the quantity of water they are capable of delivering, the present floating engines surpass the machines they have displaced; but in the quality of their performance, as regards the labour required, and altitude of jet, they have never yet equalled the old crank-worked engines. In a trial which took place some time back between one of the

reciprocating engines and the old crank-worked engine belonging to the London Dock Company, with an equal number of men, and similar sized nozles, the superiority of the latter was very apparent. The old firemen often talk exultingly of the "old floats." Among other remarkable performances of the old "Sun float," one at a large fire on the Adelphi terrace, some years ago, is worth special notice. The hose was led from the engine up on to the terrace, where the branchman stood, and delivered a jet that topped the highest of the buildings. The failure of the modern floating engine to impel a jet at the Tower fire, was noticed at page 167 of your 36th Vol. At the fire at Topping's wharf last year, a floating engine came up after the roof of St. Olave's church had been burning some time; the hose was led up into the churchyard, but it was not until a small nose-pipe had been affixed, that the jet could be delivered on the burning roof; a performance inferior to what the old "Sun float" accomplished at the Adelphi fire, with *half the number of men*. The great superioriy of the crank-worked engine has also been shown by the Emperor of Russia's floating engine (built by Merryweather, London, *vide* Vol. xxxvi., p. 178) at Cronstadt. This engine can leave its moorings at a moment's notice, proceed at a speed of eight miles an hour to any required locality; on arriving there, it can in one minute deliver a towering jet of water from 100 to 130 feet high. But while the Russian government has availed itself of modern improvements, and the *Neva* can boast a fire-engine which has no rival in the world, our own Government has been humbugged into the adoption of machines in every respect inferior, and which for the purposes to which they were intended to be applied, are almost wholly useless. In June last, a loaded transport took fire off Deptford Dock-yard, and the Government floating engine was, by great exertions got alongside, *but not until upwards of an hour had elapsed*,* and there was no possibility of extinguishing the fire but by scuttling the vessel.

Although much stress may be laid upon the "loss of power by the crank," in certain applications of that agent, I agree with the writer who has asserted that "there is a decided superiority in the working of rotary (that is, crank-worked) engines over those of the alternating kind; the relative uniformity of motion in all the working parts being highly favourable to the development of the utmost powers of hydraulic or pneumatic machinery."

I remain, yours respectfully,
WM. BADDELEY.

29, Alfred-street, Islington,
December 2, 1844.

* Vide the *Times*.

SOCIAL STATISTICS OF PARIS.

From the little reverence paid to religion and the laws by the lower orders of people in Paris, joined to the slender recompense of industry among the well-disposed, in consequence of the narrow policy of the French in manufactures and commerce, and the want of legal provision for the poor, there is undoubtedly a greater mass of squalid destitution and reckless profligacy in their capital than in ours. Such characters and scenes as are depicted in the *Mystères de Paris* might be deemed fictions of the novelist, were they not delineated in still more hideous lineaments in the official reports of the *Conseil de Salubrité*. In the last number of the *Annales d'Hygiène Publique* for October, 1844, published under the superintendence of thirteen men of science, seven of whom are members of the *Conseil*; there is a Memoir on the Medical Topography, of the Arrondissements of the city of Paris on the south side of the Seine, from the Gobelins and the Jardin des Plantes down to the Military School and the Hotel des Invalides. Dr. Henri Bayard, the author of this elaborate Report, describes the manner of life of the inhabitants of these several *arrondissements*, or parishes, the state of their dwellings, the condition of the soil, sewers, factories, markets, slaughter-houses, deposits of offal, statistics of disease and mortality, &c., with a minute and conscientious fidelity. Such scientific investigations must lead to many reforms of the sad scenes of want and corruption so clearly portrayed; and it is to be regretted that no similar searching inquiries have been made and published for the several parishes of London, by men competent to the task by activity, knowledge, and independence.

In the same number of the *Annales*, M. Chevallier, an eminent chemist, and member of the Conseil, has published a dissertation on *the Alterations and Falsifications of Alimentary Substances;* in which he has inserted a petition, prepared by himself, to be presented to the Chamber of Peers and to the Chamber of Deputies, urging upon them the necessity of enacting most stringent laws for the repression of that class of frauds so hurtful and dangerous to the community. He considers the bread in Paris to be generally good, and not at all sophisticated with drugs, as it is in Belgium, and, he might have added, in this country.

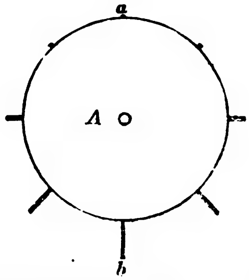
M. Bussy, another able chemist, has likewise, in the same Journal, laid before us, his examination of different sorts of flour which are used for baking inferior qualities of bread, called *dog's bread*, but which the poor are often tempted to eat. Such bread is baked with damaged flour, and is characterized by its becoming mouldy in a short period of time, and reddening strongly litmus paper, as indeed most of our London bread does, when only a few days old. On subjecting certain kinds of flour used in making the so-called dog's bread to the analysis for gluten, M. Bussy found this important element of nutrition to be destitute of its natural properties, without elasticity, and incapable of swelling up when heated, as good gluten always does. He very properly suggests that the privilege of baking such bread ought to be restricted to certain bakers, who should be prohibited from baking loaves for the consumption of man.

ENCLOSED PADDLE WHEELS.

Sir,—In my endeavours to discover a simple easy method of keeping the float boards of steam-boat paddle wheels constantly vertical, I contrived a very different arrangement which may even be more serviceable, and not without its interest to your numerous ingenious readers.

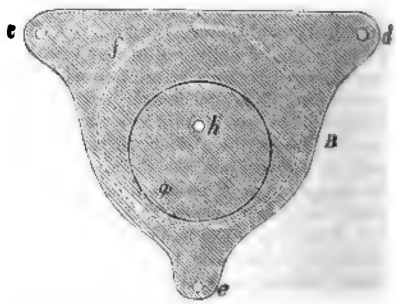
Imagine a drum wheel from which paddles protrude as exhibited in the adjoining diagram, fig. 1. A being the wheel, and *a* the upper paddle, quite or almost invisible, while the paddle *b* is advanced to its utmost pitch; and always presenting the same appearance whether

Fig. 1.



the vessel goes ahead, or her motion be reversed. I may notice, however, in passing, that the wheel itself would not be seen precisely as in this view, but the paddles, always similarly, as will presently be easily understood.

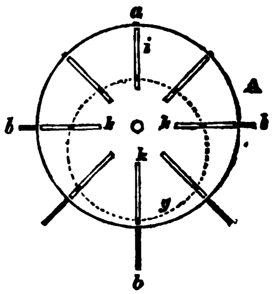
Fig. 2.



My method required a strong cast-iron plate, B, to be firmly bolted to the vessel's side, for which purpose are provided three bolt holes, *c, d, e*. This face-plate has a hole drilled at *h* for the paddle-wheel shaft; and the space occupied by the circumference of the drum-wheel is defined by the dotted circle, *f*; within this appears the lesser circle, *g, h*, which requires to be very truly turned, and may be supposed to form a groove 1 inch broad and 1 inch deep—these dimensions varying, of course, with the size of the wheel and power of the engine. If we suppose the wheel to be 2 feet broad, then would a plate similar to that described be placed precisely opposite this one, at a distance of 2 feet, and 2 or 3 inches, so as to afford sufficient play for the paddle-wheel when in its place between these two plates—kept equi-distant by strong iron stays, which might besides afford the means of bolting the first plate to the vessel's side.

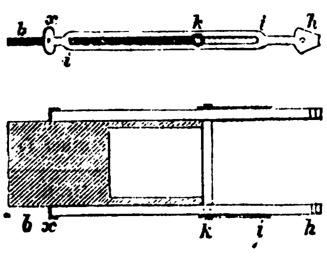
Having now all ready for the paddle-wheel, we find that to consist of a stout iron drum, fig. 3, with eight slots, as at

Fig. 3.



i, cut into the sides, but neither reaching the centre, nor touching the outer edge. Horizontal slots, at right angles with each of these, are cut also in the edge of the wheel, and it is through these the paddles, as *b b b*, protrude, being kept in their places by the slots in the rim, and by guide nuts, as *k k k*, at the other extremity of each paddle. And it will be observed, in this diagram, that each of the eight guide nuts, *k k k*, is shown on the dotted eccentric circle *g*, corresponding with the same reference in fig. 2. However, it is only when the wheel is in its place between two plates constructed like fig. 2, that the floats can retain this position, in consequence of the corresponding groove in each plate retaining the corresponding nuts on each side of each float in this peculiar position. The wheel by itself, as in fig. 3, allows of *each* paddle being drawn up and down *by hand* to the full extent allowed from the nuts *k* to the rim in the side slots *i*. Though the sides of this wheel are described as circular plates of metal, it is obvious this form of a drum or wheel may be dispensed with by substituting a series of eight double arms, thus—

Fig. 4.



Here *x* to *h* is one of the iron arms or spokes; *i i*, the slot; *b k*, the paddle; and *k* the guide nut, as seen at one side, there being another in the corresponding spoke on the opposite side.

It is thus seen why the two face plates, with opposing eccentric grooves cut in them are required, as these paddle-wheels would otherwise be powerless and useless. Yet I am far from considering this anything like a perfect invention; there would be great friction, and however this might be attempted to be obviated, I fear it could not be done without, on the large scale, creating a disagreeable racking noise, the absence of which, in the good old common wheel, combined with its other advantages, induces engineers and steam-boat proprietors to forego availing themselves generally of any of the many supposed improved propellers, with the solitary exception of the screw, notwithstanding the large amount of capital that has been expended in perfecting many schemes, and in contesting the legal rights of others, as patent property.

I am, your obedient servant,

H. D.

Lincoln's-Inn Fields, November, 1844.

BEALE'S ROTARY ENGINE.

Sir,—The Table communicated by your correspondent, Mr. Baker, has supplied some important data for determining the merits of that class of rotary engines which the inventor, Mr. Beale, has called "the rolling or non-friction class." By referring to this Table, it will be seen that when the pressure was 38 lbs. to the square inch, the power equal to 12·34 horses, and the piston travelling at 595·5 feet per minute, the engine propelled an immersed midship section = 9 square feet at a velocity of only 8·7 miles per hour, and this, too, in a vessel constructed from the lines of a *man-of-war's pinnace*, which, though not, perhaps, so good as those of some of our clipper steamers, are known to be not the most unfavourable for speed. Now let us compare these results with those obtained by means of engines of ordinary construction.

The *Infant Prince*, fitted with a stern propeller invented by Mr. Hunt, which, with his steering apparatus, was described in your Journal two or three years back, has engines of the common reciprocating kind. When working to 12 horse power, she propels upwards of *eighteen square feet* of immersed midship section at a velocity of upwards of 10 miles per hour. It will be

further seen from the Table that it requires 60 lbs. pressure, a piston speed of *only* 744 feet per minute, and engine power of above 20 horses, to propel 9 square feet at a velocity of 9·96 miles per hour. The ordinary engines in the *Infant Prince*, therefore, propel above *double* the immersed midship section at a greater speed, with less than *eight horse power*.

It may be said that the *Infant Prince* has slightly better lines for speed than the *Pigmy Giant*. Admitted; but what difference of construction would account for results so widely different, and so fatal to the class of *frictionless* engines?

The *Mystery*, a vessel with stern-propeller, constructed by the same parties (Messrs. Penn and Co.) as the *Infant Prince*, and fitted with a pair of 10-horse engines, has equalled in speed some of the Watermen's steamers, acknowledged to be heretofore the fastest of their class on the Thames. It is to be hoped that Mr. Hunt will forward you some particulars of this vessel, which is the first on a large scale of a plan already described in your valuable miscellany.

It has been stated by Mr. Beale that the ends of the revolving piston, and also the ends of the rollers do not wear to any great extent. This appears to me practically impossible. If the ends do *not fit* against the end of the piston and roller, steam *must pass*; and if they *do fit*, the immense difference in the velocity of the rubbing surfaces must cause rapid wear; and however well they may work for a few weeks, or perhaps months, they must soon become good for nothing.

I remain, Sir,
Your constant reader,
SCRUTATOR MECHANICUS.

THE PROPELLING EXPERIMENTS WITH THE "PIGMY GIANT."

Sir,—Your correspondent, Mr. Baker, is not satisfied with my strictures on his "Summary." * * * I shall, therefore, examine his communications at greater length.

He says that *going well* is a vague term. Granted, *it is a vague term*; but it is only a *repetition of his own words*, for at the commencement of his former letter he remarks that "she drops at the stern when *going well*." Mr. Baker observes that the "*intelligent reader*" will immediately perceive that the column headed "Water pumped in boiler in cubic feet per hour," "consists merely of arithmetical calculations founded on the data furnished by the four original columns;" and yet he gives it as the result of EXPERIMENTS.

Mr. Baker states the pump to be 3½ inches throw, which accords with his table; but, in fact, it never reached a throw of 2½ inches! So much for his arithmetical calculations. Perhaps Mr. Baker may be informed by "the intelligent reader," that until he knows the temperature of the water pumped into tho boiler, and the *correct* throw of the pump, he cannot tell how much its action will become deteriorated by the vapour arising from the water, and also that any boiler will prime when the steam finds vent quicker than the boiler can supply the demand, whether the pressure be low or high. Mr. Baker himself admits, that when high, it "*entirely disappears*;" or, in other words, when the boiler is properly managed, *there is no priming*. "*The intelligent reader*" may also be disposed to doubt that, when the water is between 6 and 7 inches from the top of a boiler (the total length of which is only 3 ft. 3 in. from the top of the firebox), that it proves that the water is priming into the engine. In the remarks he has last favoured you with, he denies, with characteristic coolness, his former unfounded assertion, that "no correct account of her consumption of fuel has been kept." Verily, Mr. Baker *should have a good memory*.

Practical men know too well the difficulty of propelling a small vessel to render it necessary to make any remarks on that point. The performance of the *Pigmy Giant* is unrivalled. Where is there any other vessel of *little more than four times her beam in length*, and at all approaching the *Pigmy Giant* in size, that ever attained so high a velocity?

I am, Sir,
Your obedient servant,
JOHN BEALE.

East Greenwich, December 2, 1844.

P.S. In Mr. Baker's last letter the words "Speed of piston in feet per hour," should have been "Speed of piston in feet per minute."*

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

WILLIAM HENRY BARLOW, OF LEICESTER, CIVIL ENGINEER, *for improvements in the construction of keys, wedges, and fastenings for engineering purposes.* Patent dated, March 6, 1844; Specification enrolled, September 6, 1844.

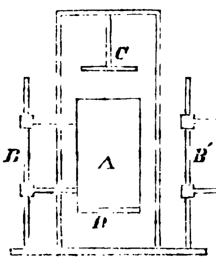
The invention of Mr. Barlow does not consist in any peculiar mode or modes of constructing keys, wedges, or other fasten-

* A typographical error, which Mr. Baker has himself pointed out in a note he has sent us.—ED. M. M.

ings; but solely in forming them of hollow metal, so that a degree of elasticity may be obtained, together with strength and lightness."

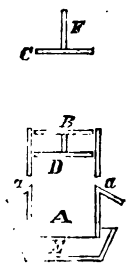
Henry Clayton, of Upper Park-place, Dorset-square, Regent's-park, Plumber and Machinist, *for improvements in the manufacture of tiles, drain pipes or tubes, and bricks.* Patent dated, March 30; Specification enrolled, September 30, 1844.

The first of the improvements set forth in this specification consists in the application of a machine of a particular description to clearing the clay from stones, roots, or other such substances. The following figure shows the principal parts of this machine.



A is a cylinder, which is attached to the upright bar B by two rods; the rod or bar B is capable of revolving upon its axis, so that the cylinder may be removed thereby from its present position (immediately under the piston C), so as to allow a second similar cylinder, A^1, fixed upon the rod B^1, to come into its place. D is a perforated plate, of which the perforations may be large or small according to the fineness of the clay made use of. The cylinders are filled with clay, and then brought into their position below the piston, which is brought down upon the clay by means of suitable gearing attached to the crosshead of the piston; the clay is by this means forced through the perforated plate in numerous small threads, while any stones, &c., it may contain, are retained upon the top of the perforated plate. When the clay thus cleansed has lain for two or three days, it is ready for being made into tiles, &c., which is performed by the following process. The perforated plate D is removed, and another one put into its place, having a hole cut in it of the form of a section of the tile. The clay is now put into the cylinder, and pressed through the hole by which the tiles, &c., are formed. There is a gauge placed under the cylinder to regulate the length when they are cut off by a wire. Sometimes two or more holes may be perforated in the plate, by which as many tiles or pipes may be formed at once. In forming pipes, the holes are provided with a piece of some hard substance projecting downward, which forms the core of the pipe. Flat tiles may be made in the same way, and ovals or other forms can be cut throughout the length of the pipe, by which two hollow tiles will be formed.

A second improvement consists in a machine for making bricks, the chief feature of



which is the box or form. A, in the above sketch, is a section of the box. B is what forms the bottom, and upon which the clay is either laid by hand or by a feeder, worked by the machinery to which it is attached. C is another piece of metal, which forms the top of the box, and D a sort of piston, which is packed with some soft substance. E is a vessel containing oil, or other substance, to lubricate the box A. When the clay is put on B, the rod F begins to descend, bringing down with it the plate C. The bottom plate B is also descending; but when it has arrived at the bottom of the box A, it stops, while the plate C continues to descend, until it presses the clay to the proper thickness for a brick. The apertures *a a* are for the escape of the superfluous clay. As the plate B and piston D are raised up, the box A is lubricated.

Another form of machine is also described for making tiles by means of two surfaces coming together, and having the form of the tile cut out therein. The patentee dusts all the articles used in the making of tiles with dry unslaked lime.

The principal things claimed are, the perforated plates for clearing the clay; the plates for forming the tiles; the method of lubricating with oil; also a method of lubricating by having the piston C formed like a cup on the top, for containing water; the process of dusting with dry lime; and a simple machine by which the patentee cuts all his tiles to a length by hand, just previous to their being put into the kiln.

RECENT AMERICAN PATENTS.

[Selected from Mr. Keller's abstracts in the *Franklin Journal.*]

IMPROVEMENT IN THE COMBINATION LOCK FOR DOORS. *Sabin Colton.*—We have here another of that almost endless variety of devices for preventing the picking of door and other locks, by means of impediments put in the passage of the bolt, which are intended only to be removed by setting them to a combination of letters, or figures, which may, for greater security, be varied at pleasure. In the modification, under consideration, the bolt is thrown in and out by a knobbed spindle and bit, and the impediment to its inward movement is a slide which works in a box attached to the back end of the door-plate. When the bolt is out, and the slide is pushed and retained in, it projects from the lock-plate, and behind the bolt far enough to be a complete check, and it is retained in that situation by buttons, or disks, on the ends of three, or more, spindles that work in the slide. These buttons, or disks, have a portion of their diameter cut off, so that in one situation they are narrow enough to pass with the slide through the box, and in other situations they project beyond the width of the slide, and catch on to a piece which projects from the back of the plate; the forward end of these spindles is adapted to receive a key, by which they are turned, and by figures, or letters, marked on the key and door-plate, the combination desired can be formed and pointed out as in the Bramah Lock. The patentee claims "the manner in which he has combined the slide contained in the box, and the spindles therein carrying the buttons on their ends, which are made to catch on the piece" projecting from the back of the lock-plate, "when acted upon by the key; said apparatus operating as a whole, substantially as described."

IMPROVEMENT IN PLATFORM SPRING SCALES. *George R. Moore.*—Instead of attaching, or suspending, the article to be weighed to a rod attached to a spring, according to the usual mode of making spring scales, it is placed on a platform attached to the top of a vertical rod suspended by the ends of a cross bar attached to it, to two arms of a rock shaft, which is also provided with two other arms opposite to them—to one of these the spring is attached, and to the other, which is longer, is suspended a dish to receive the weights for weighing beyond the force of the spring. From one end of this rock shaft another arm extends down, and is jointed by a link to an index hand, turning on a pivot, which points to the graduations on an index on the box that surrounds the whole, except a portion of the hand, and the end of the lever to which the dish is suspended. The lower end of the rod to which the platform is attached, is kept in a vertical position by a jointed bar, in the usual way.

The claim is limited to the "combination of the spring balance, with the steel yard, substantially, in the manner described." "And, also, in combination with the above, the hand, or indicator, and index, arranged as specified."

IMPROVED LET OFF MOTION FOR REGULATING THE DELIVERY OF THE YARN IN WEAVING LOOMS. *William H. Brayton.*—The yarn beam is, by means of a cog-wheel and pinion, put in connexion with a friction pulley, around which passes a friction band, having one end fixed to the frame by a screw adjustment, and the other by means of a rod, or spring, to the lower end of an upright lever jointed to one of the swords of the lathe, the upper end of which is jointed to a finger, or short arm, projecting downwards from a small shaft extending across the back of the lathe; and from this shaft project upwards, two other arms, or fingers, which bear against the back of the flighter, or spring reed. The yarn is not given out by the beam unless the friction band on the friction pulley is loosened, which does not take place until the strain of the web, in beating up, be sufficiently great on the flighter, or spring reed, to cause it to yield, and then, by the connexion above described, the friction band is loosened, and the yarn given out.

The claim is limited to the "mode of connecting the yarn beam with the flighter, by means of the friction strap and pulley."

IMPROVEMENT IN BEE HOUSES. *Aaron E. James.*—The patentee says: "What I claim as my invention, and desire to secure by letters patent, is the combination of several hives furnished with inclined floors, and two honey boxes on their tops with the bee palace in the manner set forth; that is to say, said hives being moveable, and having the entrance for the bees in the middle, between the two inclined floors, and corresponding to an entrance in the floor of the palace, said entrance having an inclined alightning board, and slides to close the hives at pleasure."

MACHINE FOR MOULDING BRICKS. *John Booth and William H. Stevenson.*—In this machine there is a cistern with a vertical shaft and arms for mixing, or tempering, the clay in the usual manner. This cistern is square, and its bottom is pierced with four holes corresponding with the four sides of the cistern. Below this cistern the frame is adapted to receive two mould frames that run entirely across, at right

angles to each other, and so let into each other as to slide freely at right angles, and have the tops of all the moulds (which are placed one set at each end,) level, and as nearly in contact with the bottom of the cistern as may be consistent with the operation of the machine. The moulds are filled in succession by an inclined board, called the filler, attached to an arm near the lower end of the mixing shaft, which, in passing around, forces the clay through the holes in the bottom of the cistern, into the different sets of moulds in succession. Below the filler there is a curved arm attached to the shaft, which acts as a cam to move the mould frames that are provided with rollers on opposite sides for this purpose. After the filler has passed over and filled a set of moulds, the cam follows and pushes it out, and the opposite set in, to be in readiness for the filler.

The claim is in the following words, viz., —"What we claim as our invention, and desire to secure by letters patent, is the method of filling and returning the moulds, as described; that is to say, by means of the follower, or filler, and the curved lever, (cam) combined, operating, and arranged, substantially, as set forth. And we also claim the manner in which we have combined with the cistern and its revolving shaft for tempering the mortar, the mould carriages constructed, and operating, substantially, as set forth."

Improvement in Moulds for Casting Butt Hinges. *Benjamin F. Harley and John W. Morris.*—The patentees say,— "In the old mode of casting butt-hinges, separate cores, or chills, were used, in order to form the sand mould of the knuckles of the joint of the hinge. Our invention is designed, principally, to dispense with the cores, or chills, which have heretofore rendered the casting of the half hinge very imperfect. By our method the mould, or drag, of the half hinge is formed at once, by a simple operation, directly from the pattern, and without any draft whatever, producing a mould in which a perfect half hinge may be cast. And this we accomplish by the use of a plate which has a vertical movement, and which is perforated with an aperture of a shape corresponding with that of the pattern of the half hinge, which pattern is placed in the said aperture, in a horizontal position, during the operation of filling the flask with sand."

It is obvious that the sand being filled in, and rammed over the pattern, and on the top of this movable plate, the plate can then be lifted up from the pattern with the sand, or drag, which is thus sustained, and the edges prevented from breaking off by the friction against the sides of the pattern.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method of forming the drag, or bottom part of the mould directly from the pattern for casting, as before described, or by any other mode substantially the same; that is to say, by the use of the movable plate for lifting the mould from the stationary bed, or pattern, thus dispensing with separate cores, or chills."

Improvements in the Stocking-Loom for Knitting Stockings, &c. *Richard Walker, and Jefferson McIntire.*—The patentees say,—"In the knitting-loom which we have invented, our first improvement consists in the substitution of horizontal sliding stitches for the falling-jacks, or sinkers, heretofore employed, by which means the friction is diminished, and this part of the apparatus is simplified, and much less liable to get out of order than the falling-jacks. Our second improvement consists in the manner in which we arrange and operate the needles, said needles being placed vertically, with their backs towards the front of the frame, and the depresser behind them, under the stitches; by which arrangement the work is elevated, and exposed to the eye of the operator at all times."

The second of these improvements is the necessary consequence of the first, for a change of position of the stitches requires a corresponding change in the position of the needles; and, although this change of position of the stitches and needles is considered the essential part of the improvements, the claim is limited to the method of moving the stitchers, which is effected by means of a bar, or regulator, which lies between two shoulders on the stitchers, and which, by its movement back and forth, gives them the required movement.

Claim.—"What we claim as new, and desire to secure by letters patent, is the manner in which we have arranged and combined the regulator, or bar, with the stitchers, so that said bar will, by its vibration, move said stitchers back and forth, by its action between the shoulders thereof, as described, the horizontal position of the stitches, and the manner of combining the bar with them, rendering it unnecessary to use springs, or any analogous device for retracting the stitchers."

Improvement in Conical Balance-Valves for Steam-Engines. *Thomas McDonough.*—The following is the description of this improvement, given in the specification, viz.,—"The nature of my invention consists in connecting the conical valve with the well-known balance piston, by means of a hollow stem, so that the steam

can pass through the hollow stem to act below the balance piston, and thus always have an equal pressure on the upper side of the valve, and lower side of the piston, and on the lower side of the valve, and upper side of the piston. The valve to be placed, as usual, in a chest, and the piston in a cylinder, either above or below the conical valve."

Claim.—"What I claim as my invention, and desire to secure by letters patent, as an improvement on the well-known conical balance valve, is connecting the valve with the balance piston, by means of a hollow stem, as described."

IMPROVEMENT IN THE VIBRATING STEAM ENGINE. *Ebenezer A. Lester.*—We have here a modification of the well known vibrating engine. It is suspended by trunnions, or gudgeons, at the upper end of the cylinder, and the piston rod passes out through the lower end of the cylinder, and extends from thence to the crank below. The upper cylinder head is of a semi-cylindrical form, and fits and vibrates in a corresponding cap attached to the frame, and in these are formed the various steam chambers and ways, so arranged, that by the vibrations of the cylinder the induction and eduction passages are opened and closed. The action of the engine can be reversed by means of a three-way cock in the head of the cylinder.

Claim.—"What I claim as my invention, and for which I ask a patent, is the manner of arranging and combining the steam chambers and the channels, or steam-ways, in the top piece, and the upper cylinder head, the said top piece and cylinder head being fitted to each other by their concave and convex cylindric surfaces, so as to cause the said steam-ways, or channels, to operate by the vibration of the suspended cylinder, substantially as herein set forth. And this I claim, whether the engine be constructed so as to operate without a three-way reverse plug cock, or valve, or if made, or constructed, to be capable of reversing its motion by means of such plug cock, or cocks, as described."

IMPROVEMENT IN FLASKS FOR MOULDING HINGES. *Thomas Loring.*—The patentee says.—"The flasks that I use are of that kind which enables the moulder to form any required number of moulds, by the use of one single pair; said flasks being hinged together at their corners, so that when a mould has been formed, the flask can be removed therefrom, and used for the formation of another."

"I connect the upper part, or cope, of the flask to the drag, or lower part, by means of an elastic spring hinge, or joint piece, which is so formed and combined with the two parts of the flask, that when these parts are closed upon each other, without anything between them, they shall fit together and form a close joint, the two parts being adjusted by means of pins, or ears, and being held together by means of hooks, or clasps, in the usual manner, when they are made ready for receiving the molten metal. The said spring hinge will also enable the two halves of the flask to close correctly upon a metallic card, when it is placed between them, so as to be ready for the hands of the moulder, its elasticity being such as to admit the flasks to recede to the distance of an eighth of an inch, more or less from each other."

Claim.—"What I claim as new, and desire to secure by letters patent is the connecting of the two parts of the flask together, by means of a spring hinge, formed and operating substantially as described, so that by its aid the flask may be closed, either with, or without, the piece of metal, called a card, between the two parts, as set forth."

IMPROVEMENT IN THE ROTARY STEAM ENGINE. *Abraham Pease.*—This patent is granted for an arrangement of parts to open and close the valves of a rotary steam engine. The valves are provided with connecting rods, the outer ends of which are jointed to cranked arms, which cranked arms are jointed to two arms projecting from opposite sides of the shaft of the engine. That end of the cranked arms that is jointed to the connecting rods, is provided with two rollers that embrace a bent rim, or annulus; and, as the arms rotate with the shaft of the engine, the valves are opened and closed by the bend in the rim, or annulus.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method herein set forth, of governing the connecting rods which operate the valves, viz., by attaching the said rods to the cranks, connected with the arms on the shaft in combination with the curved rim, the same being constructed and operating substantially as described."

IMPROVEMENT IN COOKING STOVES. *Jordon L. Mott.*—The patentee says.—"My improvement is applicable to cooking stoves of different kinds, as it may be applied wherever boilers, or other cooking utensils, are placed, or a boiler plate situated over the fire chamber by which they are to be heated. It consists in the employment of a lid or cap, and of two jambs, which are made to open and close simultaneously, by their combination with each other; and which, when closed, form a compartment within which the cooking utensils are enclosed, excepting towards their fronts, thereby preventing the escape of steam, and other

vapours into the room, and causing them to be conducted off; there being an opening, or escape flue, at the back of said compartment, leading into the stove pipe or chimney.

"What I claim therein as new, and desire to secure by letters patent, is the so combining of a cap and jambs, situated in the manner, and employed for the purpose herein set forth, as that they shall be made to open and close simultaneously, by the raising and lowering of the cap: the hinge joints and levers by which the same is effected, being constructed and arranged substantially as set forth; not intending, however, by this claim, to limit myself to the precise formation of the operating parts as represented, but to vary the same as I may think proper, whilst I attain the same end by equivalent means."

IMPROVEMENT IN THE COOKING STOVE. *Simon Pettes.*—In this stove the fire chamber is placed above the oven, and at the back of the stove there is a diving flue, which leads the draught down to the space between the bottom of the oven and the bottom plate of the stove, which space is divided into three flues, by means of two plates "extending about three-fourths the length of the stove—the ends next the front being wider apart than those next the diving flue, so as to make the flue gradually increase in width." This arrangement divides the space into three flues, the middle one receiving the draught from the diving flue, and discharging it into the two side flues, from whence it passes into a rising flue back of the diving flue. The diverging position of these two plates not only makes the middle flue wider at the outlet end than where it is connected with the diving flue, but gives the same character to the two side flues also.

The patentee informs us that "flues thus enlarged as they approach the outlet, are found to draw better than those of a uniform width, or contracted as they recede from the fire chamber."

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is combining a diving flue back of the oven, and the diverging plates, connected therewith, placed under the oven with the stove, as described, the whole constructed and operating as set forth."

COPYRIGHT OF DESIGNS.

Guildhall, City of London—December 3, 1844.

Mr. Ford, of Jewin-street, a trimming manufacturer, attended before Aldermen Wood and Hughes, to answer an information filed at the instance of Messrs. Hughes and Co., fancy trimming-makers, in Wood-street, for imitating a fancy trimming, registered, as a new and original design, on the 6th of March last.

The information charged that the defendant sold a fraudulent imitation of the registered design between the 1st of November and the 19th of November.

Mr. Goddard, a solicitor, stated that he appeared on behalf of Messrs. Hughes and Co., of Wood-street, who had registered a new description of trimming for bonnets and caps, and he commenced an explanation of the objects and utility of the Acts for the protecting the interests of ingenious persons who introduced anything novel.

Mr. Clarkson, for the defendant, said he believed Mr. Goddard need not travel over this ground, as the Magistrates were well acquainted with the law.

Mr. Alderman Wood said the first proceedings under these Acts were taken before him.

Mr. Alderman Hughes said he had also heard a case under the Act, and the design in dispute was similar to that now in question.

Mr. Goddard then produced two round boxes of trimming, and called,

Mr. Hesketh Hughes, who deposed that one of the boxes contained a trimming invented by his wife on the 1st of March. It was the design described in the certificate of registration produced.

Mr. Alderman Wood read the description in the certificate No. 16,844, class 12. It was set out as an original design, in respect to the shape of a fancy trimming, to be inserted in the centre of the lace ruches, made of ribon, crape, velvet, and other fabrics.

Mr. Alderman Hughes inquired wherein the originality of the design consisted?

Mr. Hughes said, it was in the shape of the pieces of ribbon inserted between the two frills of lace.

Mr. Clarkson asked, if that was the only novelty?

Mr. Hughes said no. The insertion of the ribbon was a novelty as well as the shape of it.

Mr. Alderman Hughes asked, if this article was not popularly called "ladies' whiskers?"—The witness said it was, because to the eye it appeared to occupy the same position as a gentleman's whiskers.

Mr. Alderman Wood asked what leaf the piece of ribbon represented?—Mr. Hughes said, it was like the double dahlia, but in the trade it was called the japonica leaf.

Mr. Alderman Hughes asked, if it was not contended, when an infringement of this copyright was brought under his notice in March, that the use of the flower leaf, in a different kind of edging or border, would be a fraudulent imitation?—The witness said certainly. It was the simpleness of the flower leaf, and the mode in which the piece of ribbon was passed, that constituted the originality.

Mr. Clarkson asked, if this description of article was not sold in January last?—The witness replied, not that he was aware of.

Clara Bolton was called, to show that she worked for Mrs. Ford as a lace ruche-maker after the design was registered; and being the sister-in-law of the complainant, she obtained a strip of the new design, and presented it to the defendant's forewoman, who admitted it was something new.

Difficulties, from the law of evidence, interrupted her examination, and another witness was called.

She gave her name Caroline Kemble, but refused to be sworn. She admitted that she was not a Separatist, nor a Quaker, nor had any conscientious scruples, but she still refused to be sworn, or to answer, till Mr. Alderman Wood threatened to commit her. She at last took the oath, and said she was formerly in Mrs. Ford's employ. She saw her make lace ruches in June. Could not say when she began to make them. She made them in July and June.

Mr. Ball, an artificial flower-dealer, in Foster-lane, was called, and being shown a box of the lace ruche, which was purchased at his shop on the

16th of November, he admitted that he sold it, and that he had purchased it of Mrs. Ford, with whom he dealt. He could not say positively, but he had purchased such in February or the beginning of March. He purchased some lace thus interleaved, but with other colours and materials, as long ago as January.

The Magistrates deemed this evidence fatal to the claim of originality for the design registered on the 6th of March, and they dismissed the information.

Mr. Alderman Hughes said that if such trifling variance could entitle parties to register, there was nothing surprising in so many thousand inventions having been registered under these Acts. But the number embarrassed people in trade, who dared not venture out of the beaten track in the least, either to the left or to the right, for fear of incurring penalties for infringing some unknown copyright.

Mr. Alderman Wood concurred in the view that the due protection to trade required that these claims to copyright should be considered with caution. With such a multitude of registered articles it was difficult for a manufacturer or shopkeeper to indulge his fancy in matters of taste.

Mr. Clarkson then applied for costs. As his client was acquitted of having committed any offence she ought to be indemnified from expense. Mrs. Ford had brought several witnesses to show the design registered was not new and original. He claimed 10*l.*, which would not, in fact, cover her costs.

The magistrates having conferred,

Mr. Alderman Hughes said it was not their wish to prevent persons from reaping the benefit of their invention, nor to discountenance applications for protection against infringements, as the copyright existed for only a short term. They thought the costs demanded too high.

Mr. Goddard proposed to see whether the witnesses could have given material evidence. He would assent to the payment of 5*l.* costs.

The magistrates thought this a fair offer, and adjudged the complainant to pay 5*l.* costs to the defendant.

ENGLISH PATENTS GRANTED IN NOVEMBER.

[*The following were omitted in our last Month's List.*]

William Bewley, of Dublin, gent., for improvements in fastenings for doors, windows, and other places where fastenings are used. November 2; six months.

Thomas Brown Jordan, of Cottage-road, Pimlico, mathematical divider, for improvements in the manufacture of blocks or surfaces for surface printing, stamping, embossing, and moulding. November 2; six months.

William Brunton, jun., of Pool, near Truro, Cornwall, engineer, for improvements in apparatus for dressing ores. November 2; six months.

NOTES AND NOTICES.

Iron Houses.—The late frightful earthquakes in the West Indies, in which the brick and stone buildings of whole towns have been levelled with the ground, and the wooden ones consumed by the fires which usually burst out after the overthrow of the other buildings, have drawn the attention of many persons residing in districts subject to those awful visitations to the advantages of houses constructed of iron, which have been found to stand the shocks of the severest earthquakes uninjured, and which are, of course, proof against such conflagrations as that which swept away at Point-a-Pitre, in Guadaloupe, all that the earthquake had spared. Some time ago, we gave an account of an iron palace built by Mr. W. Laycock, of this town, for the use of one of the chiefs of the African coast, and at the same time we showed that buildings of that kind would be invaluable in countries subject to the ravages of earthquakes. We find that this article, which was copied into the London papers, has attracted much attention in several of the West India Islands, as well as in Nova Scotia and in the East Indies, and that Mr. Laycock has since received almost innumerable inquiries and applications for plans of iron houses from different parts of the world. He has now in his workshop, just finished, a very neat iron cottage, which he has just built for the use of two maiden ladies residing in the island of St. Lucia. It consists of three rooms each 9 feet high—viz., one room 20 feet by 14 feet, and two rooms 12 feet by 10 feet. There are six large jalousy windows and two small ones over the front and back doors; these and the floor are the only parts made of wood. There is an inside ceiling of iron in panels, and the roof is in a wrought iron frame and covered with galvanized plates of iron. The walls are formed of double plates of iron, with a thin stratum of air between them, an arrangement which will prevent the passing of the solar heat into the interior of the building, at least through the walls, and keep the interior delightfully cool. The weight of the building is 14 tons, and the cost rather more than 200*l.*—*Liverpool Times.*

Fire Detector, invented and constructed by Mr. John Congor, of New York. It consists of a pump, from the chambers of which pipes may extend to every room in the building. If there be the least smoke in the atmosphere, coming in connection with the termination of either pipe, it will be drawn to the chamber of the pump, whence it escapes through an aperture, and becomes perceptible to the smell.—*New York Gazette.*

Tanning Machine.—This is a revolving wheel, to which several hides in the raw state are at once attached, and by the motion they are alternately immersed in the bark and drawn out. By this motion calf skins are tanned in six days, the ordinary time of which is three months, when lying motionless in the vat. We saw some skins, which had been in the wheel thirty-five hours, and were then very well tanned. It was invented about three years ago, by David Howell, of this city, and has been in use in Fulton county.—*Ibid.*

Curious Experiments in Optics.—It is known that tartaric acid exercises a rotary power over light, and imparts to it its saline combinations; paratartaric acid, on the contrary, although of the same ponderal composition, does not possess this property. M. Mitcherlich, a Prussian chemist, has examined whether this would be the case under circumstances in which the two bodies would be similar, not only in their chemical composition, but in their crystalline form and their physical properties; the result has confirmed the established principle; and thus (says M. Mitcherlich) we have two bodies, in which the nature and number of the atoms, their arrangement and their distance, are the same, and which are, nevertheless, distinguished by different optical properties.

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Edited by J. C. Robertson, No. 166, Fleet-street.

BILLING'S ELECTRO MAGNETIC MACHINE.

Fig. 1.

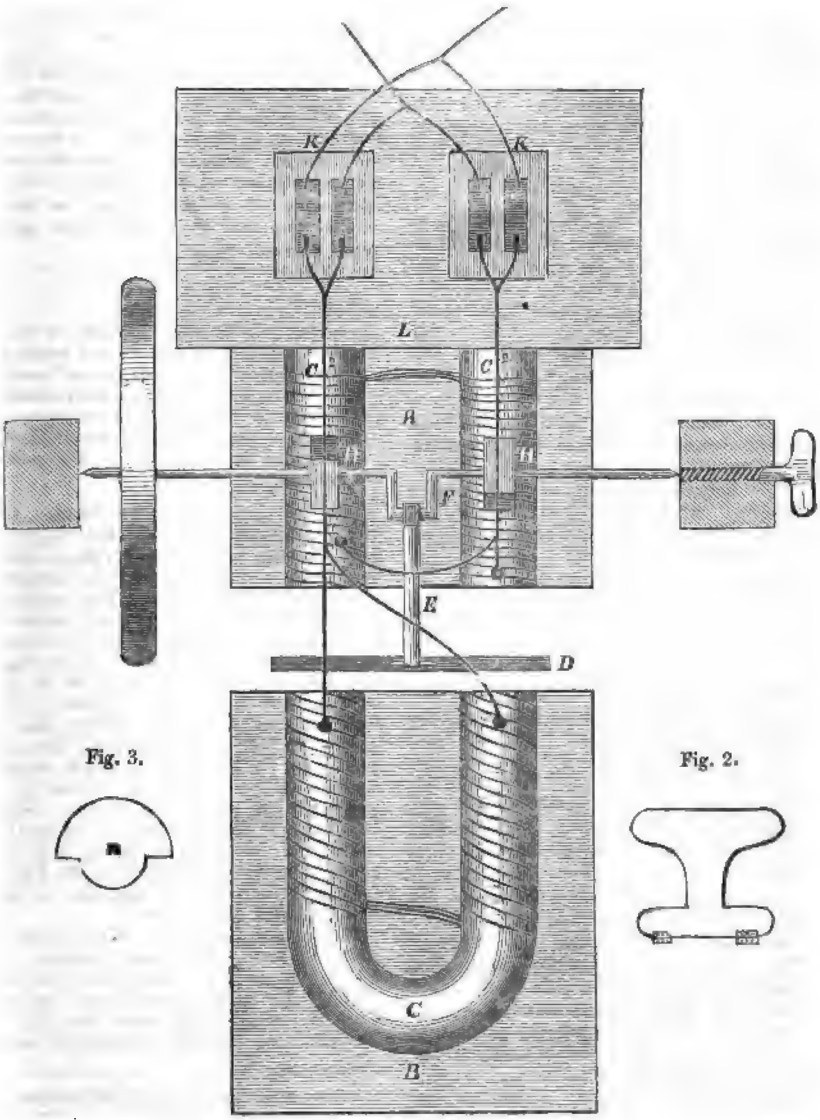


Fig. 3.

Fig. 2.

ELECTRO MAGNETIC MACHINE.

SIR,—Having seen in your interesting Journal occasional descriptions of several Electro Magnetic Machines, I am thereby encouraged to send you drawings and descriptions of a small working model, recently constructed by myself, and which answers remarkably well.

Fig. 1 represents a top plan or view of the machine. It is mounted on a piece of board, about 18 inches by 12. B B are two blocks of wood, 3 inches high, on which are raised two artificial magnets, C, C^2, 6 inches by 1½, whose faces are about 1 inch apart. The magnets are thus raised, in order that the iron plate D, which is 4 feet 8½ inches high, and moves freely between them fixed on hinges to the bottom board, may work with as little friction as possible. An elevation of this plate is given separately in fig. 2, but on a reduced scale. An arm, E, connects this plate with the crank axle, F, which is consequently made to revolve when the plate is attracted by the magnets. On the axle is a fly-wheel, G, which continues the motion.

It remained to be solved how these artificial magnets should be alternately magnetised and demagnetised? This is accomplished by fixing on the axle two wooden wheels, H H, of the form shown in fig. 3. Upon these wheels the wires from each magnet are made to press lightly. The ends dip into mercury boxes, K K, placed on a table, L, when the wires rest on the smaller diameter of the wheels; but as the axle revolves, the wires are raised out of the mercury, and thus alternately they are lowered and raised by means of the unequal diameters of the wheels upon which they rest; and thus also, the magnets are alternately magnetised and demagnetised. My first attempt was with one magnet, which was of course very simple in its action, having very little friction to contend with. The motion, which was more rapid than I could have supposed, was occasioned by the iron plate being attracted half a revolution of the crank, which was continued by the fly-wheel. The axle having thus moved round, upon which the wooden wheels, as described, are fixed, the wires were again lowered, and the revolution continued at a great speed, while it was in connexion with the battery. I then made a similar magnet, and placed it on the other side of the plate, so that the half revolution, which was before made by the fly-wheel alone, is now assisted by the extra magnet, the wires from the magnets being insulated and bound together, each pair forming one wire, so that they may pass over the wheels, and dip into the mercury boxes in pairs alternately. I am, yours, &c.

ARTHUR BILLING.

Bridge-street, Reading, Nov. 7, 1844.

P. S. I have omitted to mention, that when the magnet attracts the plate, it would adhere to it, and thereby retard the working of the machine; but to prevent this, I place on the face of each magnet a piece of thin cardboard with holes cut out about $\frac{1}{16}$th of an inch smaller than the face itself,—thus preventing actual contact.

INVESTIGATION OF THE CAUSES OF THE EXPLOSION OF THE LOCOMOTIVE ENGINE, "RICHMOND," NEAR READING, PENNSYLVANIA, ON THE 2ND SEPTEMBER, 1844, MADE AT THE REQUEST OF MESSRS. NORRIS, BROTHERS, LOCOMOTIVE ENGINE BUILDERS, PHILADELPHIA. BY DION. LARDNER, LL.D., F.R.S.

[Explosions of locomotive engines are rare events, and those which have hitherto occurred have been attended with so little damage as scarcely to have left any impression on the public mind. The accident which is the subject of the present paper is undoubtedly the most disastrous of the kind on record, and is well worthy of the elaborate and impartial investigation which it has received at the hands of Dr. Lardner. The friends of the railway system will be pleased to observe, that there is nothing in the circumstances of the accident which should diminish in the least our confidence in its superiority in point of safety over every other mode of transit. We are indebted to a kind correspondent for having it in our power to be the first to republish Dr. Lardner's valuable paper on this side of the Atlantic.—ED. M. M.]*

Having been applied to by Messrs. Norris, Brothers, locomotive engine builders, of Philadelphia, to investigate the circumstances attending the recent destruction of the engine *Richmond*, which caused the loss of four lives, and property amounting in value

* At the time this was written the accident of the 14th inst. on the South Eastern Line had not occurred.—ED. M. M.

to nearly ten thousand dollars, and to ascertain, if possible, the causes of the catastrophe, I repaired to Philadelphia on the 20th, and Reading on the 21st Sept., visiting the spot on which the event occurred, and collecting the necessary information connected with it.

The engine *Richmond* was built for the Reading Railway Company by contract, and placed by Messrs. Norris on the road on the 14th August. Its form, structure, and material were of the usual kind, and similar, in all essential particulars, to other engines working on the same line. It was, however, supplied with two safety valves, each two inches in diameter, one being as usual placed on the dome of the fire-box, immediately in front of the engine-man, and the other on the cylindrical part of the boiler, in front of the fire-box, and not within reach of the engine-man, while standing in his customary position.

It was agreed between Messrs. Norris and the company, that the engine should be run for sixty days on the railway, under the care of an engine-man appointed by Messrs. Norris, after which it was to be put in the hands of the company's engineer; but in order the better to prepare the latter for its efficient management, it was arranged that the company's engine-man, Joseph Ward, into whose charge the engine was finally to pass, should attend at Messrs. Norris's works, and assist in putting the engine together, and that he should accompany the engine-man of Messrs. Norris, in driving the engine during the above-mentioned period of sixty days. When the engine was put on the road, on the 14th August, Jos. Ward accompanied Messrs. Norris's agent, but, after the second trip, the performance was found to be so satisfactory, that it was not considered necessary to continue the employment of the engineer of Messrs. Norris, and the engine was placed, without further trial, in the charge of Joseph Ward, who continued to drive it from that time, until the epoch of the catastrophe by which it was destroyed.

Up to Saturday, the 31st August inclusive, the engine had run between Pottsville and the depot at Richmond.

On Monday, the 2nd September, the engine started from the company's coal depot at Richmond, at eleven o'clock in the forenoon, taking a train of 88 wagons, the engine being driven by Joseph Ward, attended by Franklin Tye and Peter Mahon, as firemen, accompanied by James M'Cabe, as conductor, and Matthew Smith and Patrick Nugent, as brakesmen. At Norristown, about sixteen miles from Philadelphia, two additional brakesmen, Thomas Cowden and John Webster Powell, were taken up. The train arrived at Reading at a quarter past seven o'clock the same evening. It was detained there until ten minutes past eight o'clock, when it started for Pottsville; but before leaving the town, was again stopped and delayed about a quarter of an hour, and finally left the crossing of the main street, Reading, at twenty-five minutes past eight precisely.

A storm of thunder, lightning, and rain had commenced about sunset, and continued with unusual violence till a late hour at night. The lightning was frequent and vivid, and of the kind called zig-zag lightning. The peals of thunder were loud and hard, the sound being observed to follow the flash almost immediately. The danger was considered so great, that individuals who had been accustomed to the climate feared to venture out, and it was said that such a thunder-burst had not been witnessed at Reading for twelve months past. It was in the midst of this storm that the train started from Reading. On arriving at a point of the road situated on a low embankment, two miles from Reading, a terrific explosion was heard from the head of the train; the cars were suddenly stopped; and the brakesmen on proceeding to the place of the engine, found the working part of the machine scattered in fragments about the road, and on the slopes of the embankment; the tender was thrown over upon the wheels and broken carriage of the engine, and the boiler and its appendages had totally disappeared. The bodies of the firemen, Franklin Tye and Peter Mahon, were found under the wagons, killed by fractures of the head and body, and after further search, the body of the engineer was found in an adjacent field, about twenty yards on to the right of the place of the tender, with the head cut across the forehead and the leg crushed, being quite dead. The body of Mr. M'Cabe, the conductor, was found, also dead, on the embankment at a point 330 feet ahead of the tender, and the boiler, with the fire-box, smoke-box, chimney, and the two cylinders and pistons, was discovered lying in a field to the left of the road, at a distance of 250 feet from the place where the wheels and carriage of the engine lay. At a point in the field, about thirty feet nearer to the engine, a deep cavity was left, produced by the end of the boiler striking there, and rebounding from it to the place where it was found. The mass, which was thus projected to the distance of 250 feet from the spot where the explosion took place, weighed about ten tons.

The cylindrical part of the boiler and the smoke-box were uninjured. The funnel was lying near the boiler, and partly beneath it.

The round end of the fire-box next the stand of the engine-man was flattened, so as to be crushed in and brought near the flue plate; the roof or crown piece of the fire-box was torn from the walls, the rent being generally above the angle, but in some places upon the angle at which it joins the walls or upright sides of the fire-box. The crown piece was found jammed in the fire-box between the part beaten in and the flue plate. The grate bars and ash pan were driven down upon the road with such force, that the latter took a very distinct print of the transverse wooden sleeper upon which it fell. The proper form of the crown piece is slightly concave at the lower surface, and it is secured by a series of strong cast iron stays, bolted to the upper surface, so as to aid in resisting the downward pressure of the steam. Its form, when found after the catastrophe, was at three of its four sides concave at the top, but at the fourth side concave at the bottom, the edge being curled downwards in a considerable degree. In the steam-casing surrounding the fire-box were found three holes, about three inches diameter, the edges of which were turned inwards, *i. e.*, towards the steam.

The working parts of the boiler, except the steam cylinders and pistons, which still remained attached to it, were broken into an extraordinary number of small fragments. The rods, and other parts which had any considerable length, were twisted in the most irregular and capricious manner, and were scattered in every direction around the place where the event occurred.

The rails on which the engine was moving were forced from their support *outwards*. The adjacent line of rails, beside that on which the train moved, are represented to have been both cut through, as if by the incision of a cold chisel. These rails, however, were none of them preserved by the agents of the company, and I could not obtain them for my own examination.

It appears that the engine started from the main street, at twenty-five minutes past eight,* and the watch of James M'Cabe, the conductor, was stopped by the concussion at twenty minutes before nine. The interval, therefore, between the departure of the engine from Reading and the explosion of the boiler, was fifteen minutes.

Such being the general outline of the history of this catastrophe, it remains to consider what are the several modes in which it is possible to account for it; and it appears to me, that except some one of the following suppositions, there is no conceivable explanation of it.

* See evidence of Patrick Nugent, brakesman.

First Supposition.

That the fire generated steam faster than it was discharged through the cylinders or valves, and that an accumulation of elastic vapour was thereby collected in the boiler, having a pressure which augmented in the ratio of its accumulation, until at length this pressure became greater than the resisting power of the crown piece, which, bursting downwards, caused the catastrophe.

Second Supposition.

That water was not supplied to the boiler as fast as it was consumed by the evaporation, and that thereby the crown piece and upper flues became uncovered; that, as a necessary consequence, these parts became overheated, and, possibly, even were rendered incandescent; that in this condition, water being thrown upon them, flashed suddenly into steam of enormous pressure, and caused the catastrophe.

Third Supposition.

That the engine was stricken by lightning, which broke it, tore the crown piece from the sides of the fire-box, and caused the catastrophe.

Fourth Supposition.

That lightning passing on the boiler raised some part of it to a high temperature; that the water taking up the heat was rapidly evaporated, as it would have been by contact with highly heated or incandescent metal; that steam of great volume and very extreme pressure being thus suddenly produced, the boiler yielded to the force, and the catastrophe took place.

These *suppositions* including, in my opinion, every possible cause of the observed effects, I directed my inquiries to the discovery of such facts, as were likely to supply the means of either establishing them, or setting them aside. I shall examine them successively, and state distinctly the circumstances and reasoning which have led me to their rejection or adoption, as the case may be.

First Question.

Was the boiler exploded by the undue accumulation of steam within it by reason of the fire promoting the evaporation faster than the cylinders could carry off the steam?

It appears by the evidence of Thomas Yeager, engineer of the train immediately following the Richmond, that just before starting from Reading both safety valves were blowing off. It appears, also, by the evidence of Thomas Cowden, brakesman, that the steam was blowing off at both valves just before the accident. It is evident, then, that both safety valves were

free. According to the load carried by the engine, the steam which passed through the cylinder would have consumed water at the rate of about one cubic foot per minute. To admit the possibility of a large accumulation of steam in the boiler, it would then be necessary to suppose the evaporation to proceed at a much greater rate than would be sufficient to sustain this discharge through the cylinders and the two safety valves. Mr. Kirk, the foreman of the company, proved that while the engine stood for fifty minutes at Reading, the valves were not blowing off, which shows that no accumulation was then taking place.

That the material of the boiler would not yield to any ordinary pressure, was proved by the most conclusive evidence. I caused pieces of the crown plate to be bent under the hammer, and doubled up, both hot and cold, and they showed all the signs of sound iron. I also caused pieces to be broken, which displayed at the fracture the usual appearance of the fibrous structure characterizing good iron. I also caused the crown piece to be examined by James J. Rush, Esq., engineer, of Philadelphia, and Mr. Simpson, master machinist to the railway company, whose opinions were in accordance with my own, and who declared that the explosion of the boiler by the mere accumulation of steam within it by the ordinary action of the fire could not have happened.

If there were a tendency in the boiler to make steam faster than it was passing through the cylinder, it would be accompanied by an increased rate of speed in the train. It appears, on the contrary, by the evidence of two of the brakesmen, that the speed was not increasing at the time of the explosion, and that it did not exceed ten miles an hour.

My opinion is, that if the engineer had tried to produce this explosion by stimulating the fire to the utmost, the operation of the cylinder being free, and the two safety valves having play, he could not have done it.

The question must, then, be decided in the negative, and the first of the four suppositions must be rejected as involving consequences and requiring admissions which are physically impossible.

Second Question.

Was the explosion caused by neglect or failure in feeding the boiler?

To judge rightly of this question, it will be necessary to attend to the routine of the engine man, and to consider the character of the driver of the engine which exploded, and the evidence as to the particular occasion on which this supposed neglect or failure occurred.

The boiler of a locomotive is fed with water by two force-pumps, which are wrought by the engine, and which drive the water from the tank, or tender, into the boiler. These pumps can be put in operation or suspended, at the discretion of the engine man. As the pumps are liable, from various causes, to get out of order, so that even when working they may not deliver water to the boiler, there is a cock provided in the feed pipe, called the "try cock," by which the engine man can ascertain whether the pumps, when in operation, are doing their duty. There are also several cocks placed at different heights on the boiler, called gauge cocks, by opening which the engine man can at all times ascertain the depth of water in the boiler, and whether it may require feeding.

Proper attention to the feeding of the boiler is the first and most important duty of the engine man. It is a duty the neglect of which, he knows, must be invariably followed by an explosion, from the effects of which others engaged on the train may, by possibility, escape, but which must cost him his life. It is, therefore, a duty almost never neglected even by the worst engineers. The engine man examines, from time to time, the condition of the boiler by the gauge cocks, and opens the feed pumps, so as to keep the level of the water to a proper height. There are particular occasions on which it is an invariable rule to fill the boiler. On approaching any chief station, where some delay is anticipated, the engine man ceases to supply fuel to the furnace, opens the fire door to check the combustion, and puts on the feed. By these means he arrives with a full boiler and low fire; the evaporation is suspended during the delay, and he starts again with a full boiler, the fire being restored to its activity before starting. But if the evaporation while he stands should boil down the water, he ascertains this by the gauge cocks, detaches the engine and tender from the train, and runs for a short distance along the road, with the feed pumps on, so as to fill the boiler. Also, on approaching an ascending grade where, by reason of the increased resistance, a full power of steam becomes necessary, it is the custom to fill the boiler well just before coming to the foot of the grade, so that in ascending the pumps may be shut off, and the unimpeded evaporation used during the ascent. These are rules well understood by engine men, and which it may safely be assumed are never neglected by men of good character and tried habits.

By the evidence of all the witnesses connected with the Reading railway, Joseph Ward was one of the very best and most

trustworthy engine men on the line. He was five years in the service of the company, and for the five preceding years was engaged by the Baltimore and Ohio and other companies, with all of whom he had the best character. Mr. Kirk, the foreman of the company at Reading, and Mr. Simpson, the master machinist at Richmond, both declare that they did not believe it possible that Ward could have neglected the feed pumps. It is also proved that his habits were sober in general, and that he was quite sober on the occasion in question.

But besides this general evidence, we have special proof. Powell, one of the brakesmen, saw Ward, before arriving at Reading, frequently try the gauge cock, and "saw that the boiler was well filled with water, and has no doubt that it was well filled with water, on arriving at Reading"—(see Evidence). Cowden, the brakesman, "walked past the engine just before starting from Reading, and saw Ward try the gauge cocks, and saw water coming from them." It is clear, therefore, that, on starting from Reading, the boiler was full. The explosion took place at the foot of the grade ascending at the rate of fifteen feet a mile. Ward would, therefore, as a matter of course, keep his boiler filled until his arrival at that point, as it would be necessary, while ascending the grade, to cut off the feed. All these circumstances and proofs can leave no reasonable doubt that at the moment of the explosion the boiler was well filled with water.

But it may perhaps be said, that although the pumps were put on, they might have been obstructed so as not really to deliver the feed into the boiler. To this may be replied, that the engine man had at his hand the usual test, the try-cock, to which, at all events, he must have resorted. Mr. Simpson, the master machinist of the rail-road company, says that "on approaching Reading, Ward would have fed the boiler and ascertained the condition of the pumps by the try-cock, nor would he have proceeded from Reading if he did not find his pumps in working order." Mr. Kirk, the foreman at Reading, states, that "he has every reason for thinking that these precautions were taken on the present occasion."

With regard to the general efficiency of the feeding apparatus of the Richmond, the evidence of Mr. Simpson is most clear and conclusive. He says that Ward was his pupil—had been under him as fireman, and was instructed by him in his business of engineman—that he was ten years acquainted with him—that, as much from these long habits of intimacy as from the dictates of official duty, Ward must have communicated to him any defects which, from time to time, he might have found in the Richmond, or any difficulties in working her—that during the whole time she was in his hands, he never made any such complaints—that he never mentioned an instance in which the pumps failed to deliver the feed, and that he, Simpson, does not believe that their action ever was imperfect. Simpson attended as usual on Sunday, the 1st September, at the depot, to see the necessary repairs done to the engines intended to work on Monday—that the Richmond on that occasion required nothing to be supplied except a pin belonging to the half stroke, which Ward himself replaced. That Ward said the engine drew Saturday's load (118 loaded wagons) easily, and had power to pull fifty wagons more without being strained.

If the water had been suffered to boil down so as to leave the crown piece and the upper flues uncovered, those parts must have been red hot, or nearly so. The condition of copper tubes which have been red hot is easily recognized. Those in the boiler show none of the signs of having been overheated. The copper is neither reddened nor scaled, nor rendered brittle. It has, in short, all the appearance of having been kept under water. None of the tubes have collapsed. The crown piece of the fire place shows none of the indications of having been incandescent. Among other appearances against this, one seems to be absolutely conclusive—the soot still remains thick on the under side of the crown piece. Indeed, I can positively pledge my judgment that neither the fire-box nor the flues have been overheated.

I have caused these parts of the boiler to be examined by Mr. I. J. Rush and Mr. Simpson, each of whom concur generally in my views.

In reference to this point, it is proper to observe here, that a rumour was prevalent that the explosion was produced by the imperfect action of the feed pumps. I traced this rumour to one of the brakesmen, who was accordingly examined. It appeared that he was so unacquainted with the structure of a locomotive, that he was unable to point out the place of the feed pump on such a machine, and that when he saw the engineer, Joseph Ward, on Saturday, 30th September, repairing the pin of the half-stroke, he mistook that for the feed pump, and thereupon circulated the rumour that the pumps were imperfect, and hence the reported cause of the catastrophe.

I conceive, then, that the above question must be decided in the negative, and that there is a body of evidence sufficiently clear

and conclusive to warrant the rejection of the second supposition as untenable.

Third Question.

Was the catastrophe of the 2nd September produced by the mere mechanical effects of lightning?

I think there are circumstances connected with the catastrophe which afford indications of the agency of steam, or other elastic fluids so strong, that this question must be decided in the negative. The state of the crown piece of the fire-place, the loud explosion, the direction in which the boiler was projected, and other circumstances needless to be particularized, form indications which can scarcely be mistaken.

Fourth Question.

Was the catastrophe produced by the combined agency of atmospheric electricity and steam?

The observation and researches of meteorologists have informed us in considerable detail of the various effects, mechanical, chemical and physical, produced on objects by atmospheric electritity. It is, however, a matter of regret, that the result of their labours have been limited to the mere history of these effects. The mode in which they are brought about by electrical agency has not been conclusively established. Among the effects the most prominent are those produced upon the temperature of bodies; that lightning fuses metals by raising their temperature is proved by the fact, that metal fused by lightning has fallen in liquid drops upon a wooden floor, and upon the decks of vessels, in which they have burnt holes. These effects have not been confined to masses of metal of limited dimension, nor have they been merely superficial, considerable masses have been on various occasions melted. When the lightning has not produced fusion, the iron has been rendered incandescent and soft, and reduced to the state necessary for welding it; in a word, metals have been raised suddenly by atmospheric electricity to all conditions of temperature, up to and including their points of fusion. Examples of these effects might be multiplied without end. In April, 1807, lightning passed along a large iron chain in Lancashire, in England, and so softened the links that by their own weight they were welded together, and the chain was converted into a rod of iron. The same effect was produced at different times in different places. In March, 1772, a bar of iron, four inches by half an inch thick, connected with a water pipe on the dome of St. Paul's Cathedral, was rendered red hot.

The mechanical effects of lightning consist in piercing solid bodies with holes, splitting them in pieces, bending and twisting them in various capricious forms, and in projecting their fragments, sometimes of enormous weight, to great distances. Buildings stricken by lightning, have produced a shock felt in their neighbourhood like that of an earthquake; the heaviest blocks composing their walls being scattered in all directions, and projected to distances so great as two hundred feet. A church was stricken in Cornwall, from the roof of which a stone weighing nearly 200 pounds was projected to a distance of 60 yards, another fragment being thrown to a distance of 400 yards. In another instance, in Scotland, a mass of rock 28 feet long, 7 feet wide, and 5 feet thick, was raised in the air, and projected over an eminence to a distance of 50 yards. Similar examples might easily be multiplied.

Large masses of iron are found to have a strong influence in attracting lightning, and this influence appears to be great in proportion to its weight. Thus lightning passing outside the wall of a building, has been drawn through it by an iron boiler within. Some years ago, a chain pier or bridge in England was destroyed during a violent storm, and, although from its nature it was continued into the earth, it was broken to fragments, its heaviest parts were bent, doubled, twisted, and knotted in most capricious forms, although no signs of fusion appeared upon it.

I have given these particulars in order to inform those not familiar with meteorological inquiries what are the actual effects which have been produced by the agency of atmospheric electricity; the question now is, whether this agency has been operative in the catastrophe before us.

It appears by the general evidence of the entire population around the vicinity of the catastrophe, as well as by the special evidence of the individuals who have been personally examined, that, at the time of this occurrence, a terrific storm of thunder and lightning raged; two of the men upon the train, who survived, prove that the flashes of lightning were incessant, both before and after the explosion, and that the lightning was of the species called "zig-zag lightning." It is proper here to observe that, of the different species of lightning, this is the kind by which terrestrial objects are generally stricken; this species never (or if ever, very rarely) passes between cloud and cloud, but always between a cloud and the earth.

There seems to be then present all the conditions necessary for the production of such a phenomenon; the lightning is in continual play; it is of the kind necessary to produce the effect; 18 tons of iron, in

the shape of a boiler and machinery, are present to attract it; there are abundance of disjunctions in this machinery, at least as decided as between the links of a heavy chain, by which conduction may be sufficiently broken to give full effect to the heating power of the electricity; finally, this mass is broken to pieces, its parts being scattered about in all directions, broken, bent, and twisted, and projected in considerable masses to distances analogous to those recorded in similar cases. But granting the fact supposed, that lightning struck the boiler, how, it may be asked, can the explosion be explained?—for that an explosion did take place, seems extremely probable, if not morally certain. The character and loudness of the report, and the appearance of the remains of the fire-box, are sufficiently indicative of this. We answer that an explosion in the present case, with the cylinders in full operation, and the two safety valves free, could only be caused by an almost instantaneous evolution of a great volume of highly elastic fluid in the boiler—so great a volume that, compared with it, the steam escaping through the cylinder and valves would be as nothing. Such an effect would undoubtedly be produced by a sudden access of heat imparted to any part of the boiler in contact with water, or still more effectually if imparted immediately to the water itself. If, then, the electricity thus heated the boiler, or any part of it, and that the water, as it might have done, took up the heat from the metal fast enough to prevent the latter from being fused, or rendered incandescent, the entire catastrophe, with all its concomitant circumstances, would be explained. The absence of marks of fusion or incandescence, the terrific violence of the explosion, the projection of a mass of ten tons to a distance of 80 yards, the fracture and scattering about of all the working parts, the bending and twisting of them in every conceivable variety of form, would all follow as the natural and usual effects of such agency. The freedom observed upon the bodies of the killed from the effects of the lightning, would be explained by the superior conducting power of the matter of the boiler, which, according to its habit, the lightning will seize by preference.

I pass over intentionally a supposition which might be made to the effect, that the water in the boiler might have been decomposed, and the catastrophe produced by its explosive constituents. The explanation we have given renders it unnecessary to resort to this extreme supposition, which certainly could not be supported by any reasoning which would entitle it to any degree of confident acceptation, if, indeed it be tenable at all.

Under all the circumstances of the case, I am therefore of the opinion, that the last supposition must be adopted as the only one which is adequate to the full explanation of this catastrophe. I do not forget that it may be urged that the boiler and its appendages were in metallic communication with the earth, and that during heavy rain the soil itself was in a favourable condition for the escape of the electricity; but I know that in the structure of the boiler and its appendages there were interruptions of the metallic continuity greater, both in number and degree, than between the links of a chain, and other cases, in which it is proved that masses of iron have been rendered incandescent by lightning.

In fine, if my evidence were required on this point, in a case where the rights or liabilities of individuals rendered a positive decision of the question indispensable, I should not hesitate a moment to affirm that that decision must be made on the last of the above suppositions.

DION. LARDNER.

New York, Sept. 28, 1844.

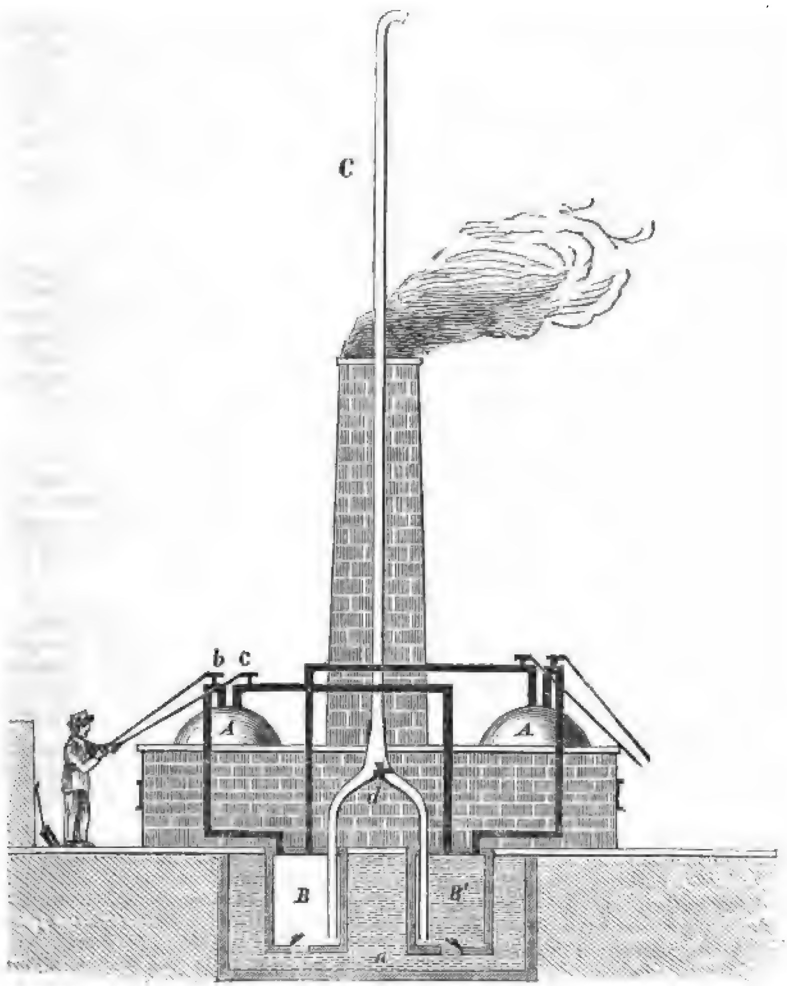
THE MARQUIS OF WORCESTER'S "CENTURY OF INVENTIONS," AND STEAM ENGINE.

Sir,—No man connected with scientific pursuits, can perhaps be adduced as having shared an equally singular fate with the Marquis of Worcester,—celebrated for his "Century of Inventions;"* but more celebrated as the reputed inventor of the steam engine. His one hundred discoveries were treated with neglect during his life-time, and his own published notice of them lay unheeded long after his death. This may be attributed partly to the spirit of the age, partly to the glowing terms in which he sets forth his claims; and possibly this neglect may be further traced to the fact mentioned by a contemporary, that "he had not a groat in his purse, or as much gunpowder as would scare a corbie (crow)." It was also his misfortune either to know too much, or to boast too much of what he did know; and his weakness of judgment in this respect as a philosopher, was equally displayed and equally fatal to

* The MS. of this extraordinary performance, dated 1655, is preserved among the Harleian Papers in the British Museum; and is given verbatim in the *Mechanics' Magazine*, vol. iii., page 18, 1825.

him as a politician. He appears to have been extremely credulous, and to have displayed a fantastic and ever zealous disposition in whatever he undertook. His very indiscretion, therefore, would alone sufficiently account for all the early neglect himself and his labours experienced.

His "Century of Inventions" is unjustly styled by Walpole, "an amazing piece of folly," and it is only surprising



that any writer on Mechanical Philosophy should be found unfeeling enough to approve rather than censure such senseless sarcasm. To Walpole these "Names and Scantlings of Inventions," must have been as a fountain sealed. Great allowance is to be made for an author of the 17th century, so much in advance of the age in which he flourished, naturally eccentric, and believing himself possessed

of valuable mechanical secrets calculated to improve his shattered fortune, and the while seeking patronage to bring the progeny of his brain into veritable existence. Let it not be overlooked, either, that in spite of his "folly," he has written a mere catalogue of mechanical contrivances which will be read with delight and profit, when the "Catalogue of Noble Authors" shall be forgotten.

The Marquis must have been a man possessed of uncommon mechanical resources, of a wonderfully active, ingenious and inventive turn of mind; and in my opinion, the regret is not that he wrote this little, but that he did not write more and leave behind him a key for posterity to unlock his wonderful casket, agreeable to his original intention. His pecuniary difficulties, no doubt, actuated him in pursuing the strong bent of his genius, and goaded by his necessities, he pursued a course which he considered (though unwisely), the best means to establish his reputation and realize a splendid income. To some minds it affords more pleasure to *project* than to *perfect*, ever starting something new, and like sportsmen, enjoy the pursuit of the game, more than its attainment. So with the Marquis, he became a confirmed mechanical projector; a very agreeable companion, and an enemy to no one but himself.

Number 68, in the "Century of Inventions," contains a notification of what is very plausibly supposed to be the steam engine in a simple crude form. As it was not the Marquis's object to describe, but barely to notify his inventions, he is as studiously vague and obscure in his statements as any modern inventor who has contrived a something to do something by which to amass a princely fortune! Fascinated as he would be by his golden dreams, can we blame his want of precision, nay, or even his apparent contradictions?

I shall now request the reader's attention to an analysis of, and commentary on, the article in question, the style of which, in the original, is peculiarly perplexing, so much so, indeed, that I consider it cannot be accidental. Relating, as it does, to what he considered one of his great discoveries, he most likely studied being prolix where he might have been brief, and condensed what should have been elaborated, stating facts without affording any striking aid to an inventive imagination. Before attempting to reinvent his Lordship's plan of engine, we must endeavour to ascertain what he proposes, and if we cannot unravel his meaning, all attempts at recontriving the apparatus will differ, and will confuse rather than enlighten us on the subject. I, therefore, venture to propose the following construction of the passage, my sole object being to clear up the obvious difficulty of reading the article without some such amplification; and by which, without any straining of the sense, I show the possibility of four steam cocks, and two steam boilers, (the boilers used alternately at *long* intervals); and two cold water vessels, used alternately in *quick* succession.

No. 68. A Fire Water Work.

"INTRODUCTION.—*I have invented an admirable and forcible way to drive up water by fire; not by drawing or sucking it upwards, for that must oe, as the philosopher terms it,* infra sphœram activitatis, *which is but at such a distance; but this way hath no bounder, if the vessel be strong enough.*

"ILLUSTRATION.—*For I have taken a piece of a whole cannon whereof the end was burst, and filled it three-quarters full of water, stopping and screwing up the broken end, as also the touch-hole, and making a constant fire under it: within twenty-four hours it burst, and made a great crack.*

HIS INVENTION.

"GENERAL REMARK.—*So that having a way to make my vessels (for hot water and for cold water), so that they are strengthened by the force (steam) within them, (the condensation of the steam facilitating the admission of water).*

"SPECIAL REMARK.——, *and the one (vessel) to fill after the other (viz. two cold water vessels, the steam from* one *boiler acting alternately on each of them).*

"RESULT.——, *I have seen the water run like a constant stream* 40 *feet high.*

"THE PROCESS, FIRST PART.—*One vessel (boiler) of water rarefied by fire, driveth up* 40 *(feet?) of cold water; and a man that tends the work (of this first process) has but to turn two cocks (one on each of two steam pipes proceeding from the boiler to the two cold water vessels).*

"THE PROCESS, SECOND PART.—*That* (that,) *one vessel (or* 1st *boiler, just mentioned) being consumed (by the action of fire), another (or 2nd boiler) begins to force and (the other, or first boiler) refill with cold water, so successively; the fire being tended*

and kept constant (under each boiler), which the selfsame person may likewise abundantly perform in the interim between the necessity of turning said (two) cocks (of the boilers in this second process, precisely as performed in the first process)."

1. "I have invented (says he) an admirable and forcible way to drive up water by fire."

He explains in the next sentence, that by "*to drive up*" (misquoted by Stuart and others "to draw up") he does not mean "by *drawing or sucking it upwards.*" He makes this amendment evidently because water could not be "*drawn* up" above 33 feet, whereas he proposes *driving*" it "40 feet high." He then gives the experiment of bursting cannon, and proceeds :—

2. "So that, having a way to make my vessels (for hot water A A′, and for cold water B B′) so that they are strengthened by the force* (steam) within them."

Probably in allusion to the steam or "force" being made the agent to admit the water as condensation takes place, on stopping one boiler to commence the next, and so preventing a collapse; or it may be merely meant that the intensity of the fire does not injure the boiler, and hence its strength, this being in consequence of the action both of the water and steam, and the having two boilers; thus, though not literally, *strengthened*, he might possibly take the license to allow it this construction. The sentence just given is completed by the following :—

3. "— and the one (cold water vessel) to fill after the other."

I consider he contemplated using two boilers A A′, thus never boiling the water too low; and two cold water vessels, B B′, as shown in the engraving.

As will appear, the boilers are worked alternately at *long* intervals, while, on the other hand, the water vessels are urged in *quick* succession. Therefore, the above line will read correctly whether we imagine it to refer to the alternate filling of the boilers A A′ only; or, the alternate filling of the water vessels B B′ only; or all four at the required intervals. I am inclined, however, to think that, though there must necessarily be this alternate filling of both classes of "vessels," that he here confines attention to the cold water "vessels" B B′, because the *boilers* are considered afterwards, and he here concludes the sentence by saying,—

4. "I have seen the water run like a constant stream 40 feet high."

In the engraving, C is the 40-feet eduction pipe. We now arrive at the most important, and yet most indefinite part of the article under review. He observes,—

5. "One vessel (boiler) of water, rarefied by fire, driveth up 40 (feet?) of cold water; and a man that tends the work has but to turn two cocks."

I here read "40" *feet*, though some have considered he speaks in reference to measure, or capacity of some of the "vessels." As only one boiler can, or need be, worked at once, the man, while "tending the work" with a single boiler, has but to "turn two cocks," *b c*. When he lowers the fire, leaves the boiler to refill, and goes to "tend" the second boiler, he still uses only "two cocks" similarly situated. In short, the operation of driving up 40 feet of water, and the refilling of the boiler, is wholly done by the man's attending to "turn two cocks." To refill the boiler A, on using the other one A′, the man closes the cock *c*, and opens *b*, when, as condensation takes place in the boiler, the water rushes from B, through *b*, into A. He adds,—

6. "—; that (*that*) one vessel (boiler, as A) of water being consumed (by the action of fire), another (boiler, as A′) begins to force and (the other boiler, as A) to refil (from B, through *b*, to A) with cold water, and so successively."

This sentence appears to be restricted to the operation of the *boilers*. I have shown in the third paragraph that the *cold-water vessels* are considered, and it would be needless repetition their appearing again. The water "being consumed" we readily trace the action of the "fire," and conclude therefrom that we have been so far conducted through the process, as if in actual operation with one boiler, just being expended; that we are obliged to have recourse to a second part in the process and get up steam in a second *boiler*, which now "begins to force," and the other "to refill with cold water." How else can we have a continuous operation carried on by this rude

* Mr. E. Galloway unnecessarily suggests a square boiler, concave on every side outside.

apparatus? The idea of a vessel contrived at once to "force and refill," by the aid of fire too, is so outrageous that *that* reading must be simply an error or studied ambiguity, and appears to me capable of no reasonable explanation in any other way than as given above. This interesting article concludes:—

7. "—; the fire being tended and kept constant (under each boiler), which the selfsame person may likewise abundantly perform in the interim between the necessity of turning said (two) cocks."

Those who are least disposed to allow the Marquis much ingenuity as a mechanical genius, will not dispute his literary talent for mystification. All we know from him about the apparatus here spoken of is, that it is an assemblage of vessels, that there are two cocks, and that by this his invention he can drive "up water by fire." Having given a dim insight into the *principle* of his invention, he cautiously abstains from more than would have sufficed to establish his claim, had an after claimant appeared. It has, for example, been suggested that he employed two boilers, and had one movable fire. But he could have shown that such a process was opposed to keeping up "a constant stream 40 feet high." Millington considers the Marquis used only one boiler and two cold-water vessels; but his description, and the conditions required, involve a necessity for using two boilers. Stuart says, his Lordship has no claim to using a vacuum, because he states "the water *is not* raised by drawing or sucking it upwards." No, but *that* has reference only to the "40 feet elevation," which certainly does not invalidate his claim for using a vacuum for "drawing or sucking it upwards" to fill his hot and cold-water vessels if so required. The same writer considers it—"practically impossible to produce an apparatus fulfilling *all* the conditions of the description." Tredgold presumes the apparatus must have consisted of one boiler and one cold-water vessel, the latter filled by one cock, and the former forcing on turning one cock on the steam pipe. To such a claimant the Marquis might have said—I provide that "one vessel being consumed, *another* begins to force," but when your boiler of water is "consumed" your process is stopped; but my "way hath no bounder" for strength, or height, or period of keeping up a flow of water to "run like a *constant* stream." Such scope does this ambiguous style of composition afford, that it is no wonder that men of science have differed in their opinions of the author's precise meaning, in what no doubt first suggested the employment of steam as an hydraulic and hydrostatic force. Dr. Robinson, Dr. Brewster and other ingenious and learned men have been much perplexed with the account I have attempted to elucidate, presumptuously enough, I fear, but still with an honest desire to lead others to do better wherein I may fail.

In the above-quoted sentence, No. 7, only one fire is alluded to; this might arise from considering that the man "tended" only *one* at a time; or, more probably, his lordship might conceive that on this part hinged some little of *his* secret—the necessity of two boilers and two fires; and that, by omitting to be more explicit, he materially mystified the matter without prejudice to the *principle* of his invention; and in such an opinion he would have been most unquestionably correct.

The "Century of Inventions," and this particular invention, No. 68, are both treated in very commendatory terms in the 3rd Vol. of the *Mechanics' Magazine*, for 1825; but in Vol. xxvi. for 1837, a review on another subject appears, in which, being incidentally noticed, it is pointedly declared, "The claims of the Marquis of Worcester to the invention of the steam-engine, are ***not worth supporting!***" And of the invention No. 68, it is affirmed to be "a description so vague, that it would require ***more*** ingenuity to *decipher* its meaning, than to invent the whole machine!" An anonymous correspondent in the same volume, page 184, says, "No one will, I think, be induced to grant either (De Caus or the Marquis of Worcester) the ***slightest*** pretence" to suggesting any one principle of the steam-engine; and, page 227, he takes the liberty of designating the noble author of the "Century," "a boastful and self-conceited writer." In the succeeding volumes of your deservedly popular journal, to the present time I find no further notice of the subject.*

Tredgold not only retains the Marquis

* The writer has overlooked some remarks contained in a recent Review of a work on the Steam-engine. See present vol., p. 11.

of Worcester, under date 1663,* as deservedly connected with the early history of the steam-engine, but also suggests a plan with one boiler, and one water vessel and cistern; but it is unfortunately an arrangement by which the continuity of the 40-feet stream must cease before the boiler is half exhausted, and which, for continuity, as before stated, compels the use of two boilers. He states that his lordship was "not acquainted with condensation." Why, he does not intimate; yet how any experiments could be made with *steam* applied to raising *cold* water, without discovering such an obvious and *troublesome* law, is difficult to understand; troublesome it would be in the estimation of those early mechanicians who applied it to the surface of cold water, producing in the present instance, as computed by Tredgold, only equal to (*in consequence of the great condensation going on*) "about the 200th part of the effect of a good steam-engine."

I am, Sir,
Your obedient servant,
H. D.

Lincoln's-inn-fields,
November, 1844.

* *Description.*

A A′ Two steam boilers, used alternately, every hour or more.

B B′, two strong iron vessels, with a valve each at bottom, immersed in

a, the well, or reservoir of water to be raised.

b c, two steam cocks, used alternately every few minutes. *b* lets the pressure of steam act on B′ to force the enclosed water up the 40-feet pipe C. In like manner *d* admits of the pressure of steam on the contents of B, and in both cases the valves at *d* are alternately opened and closed.

b is used to admit cold water from the well, *c* being first closed, previous to commencing to work the boiler A′, all the operations of which correspond with the regulations used for boiler A.

THE SPIRAL SPRING CANDLESTICK.—A MODERN ANTIQUE.

Sir,—The following is an extract from a book called "Spectacle de la Nature," or "Nature Displayed," translated from the French. The extract is made from vol. vii. pp. 47, 48, second edition, published in 1749, by R. Franklin, Covent-garden, &c.

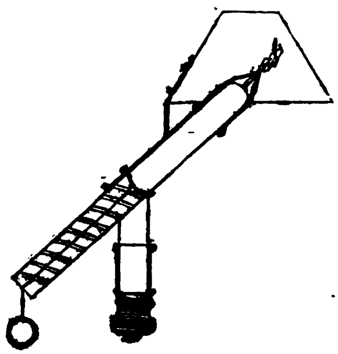
"They have invented several sorts of supports fit to improve the service of lights. They tried at first to render it brisker, by means of a reflection that might convey a greater quantity of it upon the place where you were at work; after which they endeavoured to preserve the eye, by sparing it the immediate light of the flame that gives light. The light is all we want: the flame serving only to hurt the eye, by its nearness and over great splendour. It has even been attempted, in favour of those who are for sparing expense, to render the small yellow wax candle of ten, twelve, or even sixteen in the pound, equivalent to that of a white wax-candle of six in the pound. Beside this, you have the additional advantage of a light always equal, and of breathing a pure air; whereas, a common wax-candle is offensive and lays you under the necessity of *continual snuffing*. All these different conveniences have been tolerably well reunited in the new study candlestick, of which I send you a figure. It may be put either upon a portable support, or upon a fixed movable branch, by means whereof you may have it higher or lower, and place it as near or as far as you please. *The spring, which bears against the wax candle, ought to be made of a very fine and light matter, like an iron or brass wire, in order to be pressed down without resistance, and without taking much room in the pipe.*

"You may tie to the upper part of *the spiral spring* a string that goes quite through it, and is fastened to a ring at the other end; that the ring ascending along with the first spires may be a warning, that the candle is nearly at an end, that is, when the ring is ready to touch the lower part of the pipe. This pipe will be inclined, and make an angle of forty-five or fifty degrees with the horizon or with the surface of its support; for, were it perpendicular, *the cover, whose sloping sides reflect the light upon your work*, would cast it all round the foot of the candlestick, which would fill up the centre of the concurring rays of light to no kind of purpose, whereas, the inclined pipe casts the strongest part of its light at some distance from the foot of the stand, and collects its property upon the paper you are using. The inside of the cover can never be kept too clean; but instead of having it smooth and bright (which cause a light unequal and fluttering) they have it only of an unpolished even white, like that of paper, of Spanish

* His MS., though dated 1655, was first published by his lordship in 1663.

white, of a very fine pasteboard, or washed over with quicksilver. A paper cover has some danger in it. Ceruse is with difficulty renewed or kept clean; but the wash of quicksilver is easily repeated, and of no expense."

There is here a pretty accurate description of what is now called "Palmer's Candlesticks," for his metallic wick candles, which do not require "continual snuffing." Some advantages, not possessed by these so-called modern inventions, are also mentioned. It will be perceived that the author describes the spiral spring candlestick, and alludes to the candle not requiring "continual snuffing," as things



in use, (at least in France,) at the period of his writing. The extract before made refers to a "figure;" (the book is written in dialogues) and a representation of the candlestick, &c. is given in a plate. I enclose you a rough copy of what may be called the sectional diagram as given in the plate. Surely the spiral spring candlestick, now so much in use, cannot be entitled to the name of a novelty or a modern invention. Is it a patented article?

I am, Sir, yours obediently,

INVESTIGATOR.

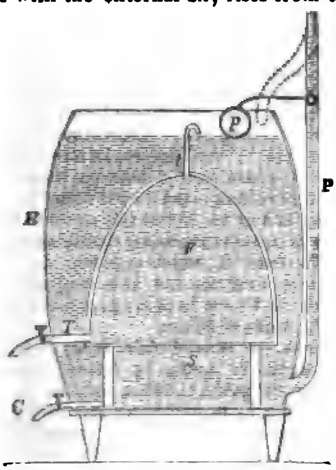
Kennington, November 25, 1844.

POSITION OF WATER SUPPLY PIPES.

Sir,—I have often thought that the principle, which *in nature* is alone employed in restoring the turbid waters of rivers and streams to a limpid state—that of simple deposition—does not obtain the place and attention it so well deserves in our artificial appliances for obtaining pure water. Judiciously applied, it might indeed, in many situations, entirely supersede the use or necessity of any filtering apparatus: but how commonly, where the requisites exist for taking advantage of it, as a cistern or reservoir connected with the water pipe of a house, is the benefit which might be derived from it almost neutralized by the circumstance of causing the water to flow in at the top, whence it happens that there is a constant addition and diffusion of fresh portions of turbid water through the mass in the reservoir, which prevents it ever becoming, so clear as it might be under a different arrangement. Its services also in aid of, and in conjunction with filtration, should not be overlooked; for in proportion as the water is previously freed from its heavier impurities by subsidence, will the filter continue longer effective, without requiring to be cleaned or renewed. This is a point little attended to, considering the advantages to be derived from it, and the facility, and simplicity of means by which it may be usually obtained. I lately met with an instance, in which, merely by the injudicious disposition of the water pipe, an otherwise ingenious and very serviceable filtering apparatus must have been exposed to frequent obstruction from a copious deposit of sediment on its porous surface; consequently, entailing ten-fold more trouble in cleaning it than there would have been any necessity for, if, instead of letting in the water from above, it had been introduced below the filter, so as to cause the sediment to deposit itself before reaching the filter. As the filter alluded to may be new to some of your readers, I subjoin a description and drawing of it, with the alteration required in the water pipe, being well calculated to illustrate the advantage of combining the principle of deposition with filtration.

A filtering stone, F, made from a block of porous sandstone, externally of a beehive or parabolic form, and correspondingly excavated within, is connected to a flat slab, supported on a stand, S, and is placed within a barrel, B, kept full of water, which continually surrounding the stone filters through its pores and remains ready for use inside. A tube T is conveyed from within the filter through the side of the barrel, and fitted with a stop-cock for drawing off the filtered water when it is wanted. Another small

tube, *t*, for preserving a free communication with the external air, rises from the



top of the filter above the water, and has its end curved downward to prevent dust, &c. entering. Water is introduced into the barrel from the water pipe, P, of the house, and kept at a uniform level by a ball-cock, B P. In the one I saw, the pipe terminated at the top of the barrel (as represented by the dotted portion of pipe,) the effect of which arrangement was very visible in the turbid state of the water in the barrel, and a film of sediment resting on the surface of the filtering stone. To avoid this and bring the water to the filter previously defecated as much as possible from its impurities, the pipe should be introduced near the bottom of the barrel as represented in the drawing. As each successive portion of water rises to the filter by a very gradual and imperceptible motion, all impurities contained in it of a greater specific gravity, will have time to take a downward or subsiding direction before they reach that height, and the filter will merely be required to intercept such impurities as do not readily separate by rest. At the bottom of the barrel there is a large cock, C, for drawing off the sediment and clearing out the barrel. This filter affords a continuous and ample supply of water for any moderate household; limpid in the highest degree, and possessing a freshness which contrasts very gratefully with the vapidness which is communicated to water by some kinds of filters.

Sir, I am, &c.,
N. N. L.

December, 1844.

THE CAMBRIA STEAM SHIP.

The *Glasgow Courier* contains a long description of a new steamer of this name, which has been built at Greenock by Mr. Steel, to replace the Columbia, lost last year, belonging to the Liverpool, Boston, and Halifax Royal Mail line of steamers. The length of the keel is 209 feet, length on main deck 221 feet, length over all 240 feet, breadth of beam 37 feet, breadth across paddle boxes 57 feet 6 inches, depth of hold 24 feet 5 inches, draught of water 18 feet, burthen 1,600 tons, two beam engines 500-horse power, length of stroke 7½ feet, diameter of paddles 30 feet, revolutions of paddles 19 per minute. The quantity of coals carried will average from 600 to 650 tons. The main saloon or dining cabin is on deck, aft the mainmast, and is 45 feet in length by 16½ in breadth. There is a clear space, however, on each side intended to serve for a promenade in fine weather. In addition to the various stores required for the ship's use, there is also accommodation for 300 tons of light goods. Besides being so well guarded with steam-power, the Cambria is fully equipped as a sailing vessel. She is square-rigged, similar to a barque, and carries an enormous spread of canvass. Her masts are of great height and thickness, and the yards on the main and foremost are each sixty-four feet long, with studding sail-booms each thirty-seven feet in length, so that the breadth of canvass of the lower square sails and studding sails, on the main and foremast alone, will be about 224 feet. The engines of the Cambria, like those of the other Halifax steamers, were manufactured by Mr. Robert Napier, of Glasgow.

RECENT AMERICAN PATENTS.

(Selected from Mr. Keller's Abstracts in the *Franklin Journal.*)

MACHINE FOR CLEANING GRAIN, CALLED THE "CENTRIFUGAL SMUT MACHINE." *Meredith Mallory.*—This machine consists of two disks, one permanent, and the other movable, provided with several rows of teeth, commencing at about the middle of their semi-diameter, and extending to their periphery. The diameter of the rotating disk, which is the under one, is less than the upper, or permanent one, which is provided with two or three rows of teeth beyond the periphery of the rotating disk. There is a fan attached to the shaft of the rotating disk, and the whole is enclosed by a conical case.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of scouring, or cleaning grain, by causing it to pass from the centre of the revolving disk to its circumference by centrifugal force, said disk being armed with

teeth, arranged and combined with an upper stationary disk, furnished with teeth, as set forth. I claim the arrangement and combination of these disks, and also in combination therewith, the fans and curb, or casing, as described.

IMPROVEMENTS IN SELF-SETTING HEAD AND TAIL BLOCKS, FOR SETTING THE LOG ON THE CARRIAGE OF A SAW-MILL. *Thomas C. Theaker*.—The head and tail blocks, under this patent, as under many others that have preceded it, have a slide to which the dogs, &c., are attached, with cogs on the under side, into which the cogs of a pinion take, the arbor of this pinion being placed across the head, or tail block, so that by the turning of the arbor the slide is moved to one side or the other. The arbor on both blocks has a segment of a cog-wheel on the end that projects outside the block, which is operated by a vertical sliding rack, and as the segment cog-wheel is connected with the arbor by a ratchet, when the rack is forced up, the arbor is rotated, which operates the slide to set the log, and on its descent, the segment cog-wheel turns, and carries back the ratchet. On the tail block, the vertical rack is forced up by an inclined plane attached to the floor of the mill; but as it is nessary that the head end of the log should be set quickly, and at the very time the saw passes out of the log, the vertical rack is forced up by a weighted lever, one end of which is jointed to a pitman, that passes through a hole in the floor just under the position of the vertical rack at the end of the back motion of the carriage. The other end of the weighted lever is provided with a cord that passes over a pulley, and is attached to a sliding hook which is disengaged by a pin at the end of the back motion of the carriage, to liberate the weighted lever, which then descends and forces up the pitman and vertical rack; the sliding hook being caught by the carriage at the end of the forward motion, to draw up the weighted lever to repeat the operation.

Claim.—"What I claim is the combination of the vertical rack which operates the slide, the pitman, and weighted lever operated in the manner substantially as set forth. I likewise claim the combination of the vertical rack, segment rack, (cog-wheel) and ratchet-wheel, operated substantially, as set forth by the inclined plane."

IMPROVED MODE OF SETTING THE LOG ON THE CARRIAGE OF SAW-MILLS. *John Miller*.—This is for setting the tail end of the log, which is, to a certain extent, done in the same manner as in the preceding patent, except that the ratchet-wheel on the end of the arbor is actuated by a lever, instead of a segment cog-wheel, and vertical rack. This lever, instead of being moved by coming against a single inclined bar to move the slide, comes against a succession of inclined blocks jointed to the floor, so that the log is set by a succession of small movements instead of a long one. The inclination of the blocks can be regulated at pleasure by means of wedges that pass in between them and a bed timber designated by the letter T, in the claim, and at the end of this series of blocks there is an inclined piece of timber, designated by the letter U, which conducts the end of the lever over the end of a long spring to enable it to run back without being caught by the inclined blocks.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the guide-blocks in sections, so as to set the log by several operations of the lever acting on the ratchet-wheel, instead of one operation, in combination with the timbers T and U, and the spring V, the guide-blocks being regulated by wedges, or other analogous devices, all as herein described."

Great Britain Steamer.—An unsuccessful attempt was made on Wednesday last to liberate this vessel from her long confinement in the Cumberland Basin, Bristol. When about three-fourths of her length had passed through the Dock, she was found to touch at the sides, and was therefore tugged back to her old position in the Basin. A correspondent of the Liverpool Mail, who recently paid this vessel a visit of inspection, speaks of her in the following terms:—"Built entirely of iron, the contours presented to the eye are of the most exquisite grace—fine and beautifully rounded in her lines, with a gentle sheer, she sits upon the water like a racing gig, her immense length looking still greater from the absence of paddle-boxes or anything to break the beautiful curves of her sides. She is the first vessel I have seen built entirely of iron, the plates forming her sides being rounded in over her timber heads, (for want of a better name I must call them so), without bulwarks, hammock-netting, or any defence but an iron railing. Nor has she the regiment of masts which the engravings represent her with—one large and heavily sparred foremast, and the low wide funnel alone breaking the sheer of her vast flush deck. In the bottom of the hold, directly under the large wheel, is the main shaft, 130 feet in length, and 16 inches in diameter. Upon the shaft, directly under the large wheel, is a drum, 6 feet in diameter, and round this and the driving wheel pass three endless chains, formed like the fusee chain of a watch, which are received into grooves corresponding with their links both upon the wheel and the drum, and thus communicate the power, the propeller shaft making about three revolutions for each stroke of the engines. Outside the vessel appears the propeller, formed with four vanes, like the sails of a windmill, but broader in proportion, and only six feet in diameter." [On Thursday another and more successful attempt was made. The vessel cleared the dock, and reached the King's Roads in safety. She may now be daily expected in the Thames.]

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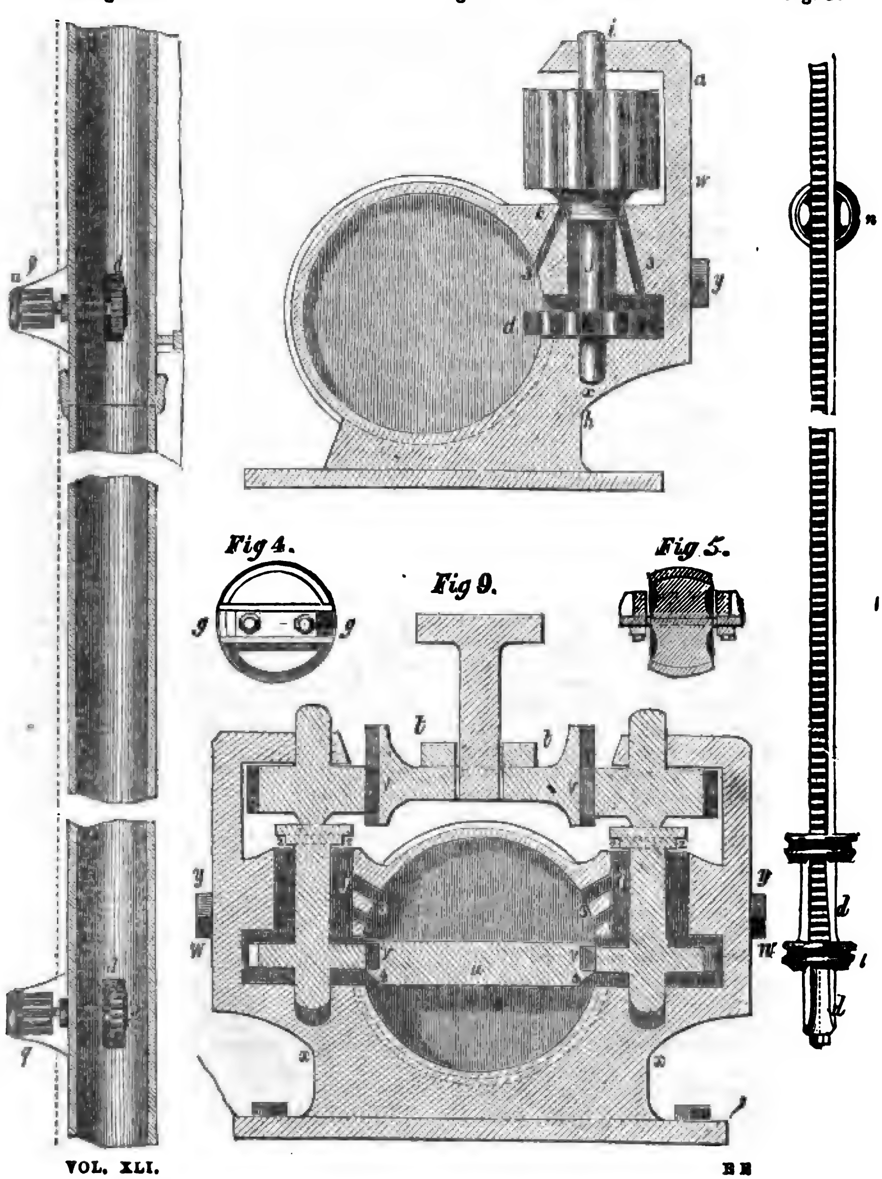
PILBROW'S IMPROVED SYSTEM OF ATMOSPHERIC PROPULSION.

Fig. 1. Fig. 2. Fig. 3.



PILBROW'S IMPROVED SYSTEM OF ATMOSPHERIC PROPULSION.

[Patent dated, May 17, 1844; Specification enrolled, Nov. 15, 1844.]

NEITHER the extensive discussion which the atmospheric railway system has undergone, nor the brief experience which has been had of it on the Kingston and Dalkey line, can be said to have as yet established more, than that it is a practicable system for short lengths of railway, and as economical for such lengths as (but not more so than) any other. The objections advanced some six months ago by Mr. Robert Stephenson, to its applicability to long lines of large traffic, having many stages and crossings, remain, in every material point, unanswered and unrefuted; for we cannot dignify with the name of answer or refutation, the mere verbal criticism, or worse vituperation, to which the assailants of the elaborate and masterly investigation by that gentleman have hitherto found it convenient to confine themselves.

While such is still the state of things in regard to this question, Mr. Pilbrow has come to the rescue with a plan which promises so to improve the atmospheric system as to obviate all Mr. Stephenson's objections; and doubtless this is the best and most effectual way of meeting them. The "continuous valve" of Messrs. Clegg and Samuda, which is the great source of waste of power, attending the system as now reduced to practice, Mr. Pilbrow dispenses with altogether. The "discontinuance" of the main tube at every three mile station, which is another great defect, and the chief cause of the unfitness of the present system for long, main trunk lines, he renders also unnecessary; with him the continuity of the main, whatever may be its length, is unbroken, and other tubes may not only communicate with, but cross it at any place without the least interruption or inconvenience. He requires no section valves, bridges, &c., for crossings; no cranes, or other contrivances for lifting carriages on and off; and instead of a stationary engine every three miles, he requires but one every ten—probably fewer. All who are acquainted with the subject will at once admit that, if Mr. Pilbrow has in truth accomplished these things, he has done that for the atmospheric plan, which must advance it immeasurably beyond the point where it has been for some time stationary, and most probably make it no longer a matter of question that it is, for all situations, and under all circumstances, superior to the ordinary system. We entertain ourselves a most favourable opinion of Mr. Pilbrow's invention. We have carefully investigated it in all its details, and can see no reason why it should not perform everything that is predicated of it. We have witnessed also an experimental trial of it, which, if there had been any doubts of its perfect practicability remaining on our minds, must have removed them completely. The scale of the trial, it is true, was a small one; but the practical facts demonstrated by it, were not of such a nature that any difference in magnitude could materially affect them.

The following descriptive particulars of this important improvement we extract, in an abridged form, from a pamphlet which Mr. Pilbrow has just published:*—

Fig. 1 is a longitudinal section of part of a pipe or tube supposed to be lying along a railway between the rails, similar to the tube on the plan of Messrs. Clegg and Samuda. At intervals (say at 30 feet or less) along this tube there are affixed small cogged wheels, as shown at *a* and *b*, having the same number of cogs or teeth each, so that the wheels may work the one upon the other. The tube has a projecting case cast upon it (as shown in the transverse section, fig. 2) at the places where it is proposed to place these pinions, and also has an opening in it to allow of the lower portion of the under pinion projecting a short way into the hollow of the tube, as shown at *d*. The upper and lower ends of the spindle work in holes or bearings made for that purpose in this projecting case or box, as at *h i*, the box having a support carried up, as *a*; but that part of the spindle or axis between the toothed portions does not touch, but passes through a hole or passage made in the tube and box, which is larger than the spindle, as at *j*; but there is a flat or conical part, at *k*, which is allowed to touch, for the purpose to be explained hereafter. These pinions, therefore, are free to turn, when acted upon in any proper manner for that purpose, and are partly inside the tube and partly out. Mr. Pilbrow next proposes that a piston should

* Atmospheric Railway and Canal Propulsion, and Pneumatic Telegraphs. By Jas. Pilbrow, C.E. London, 1844.

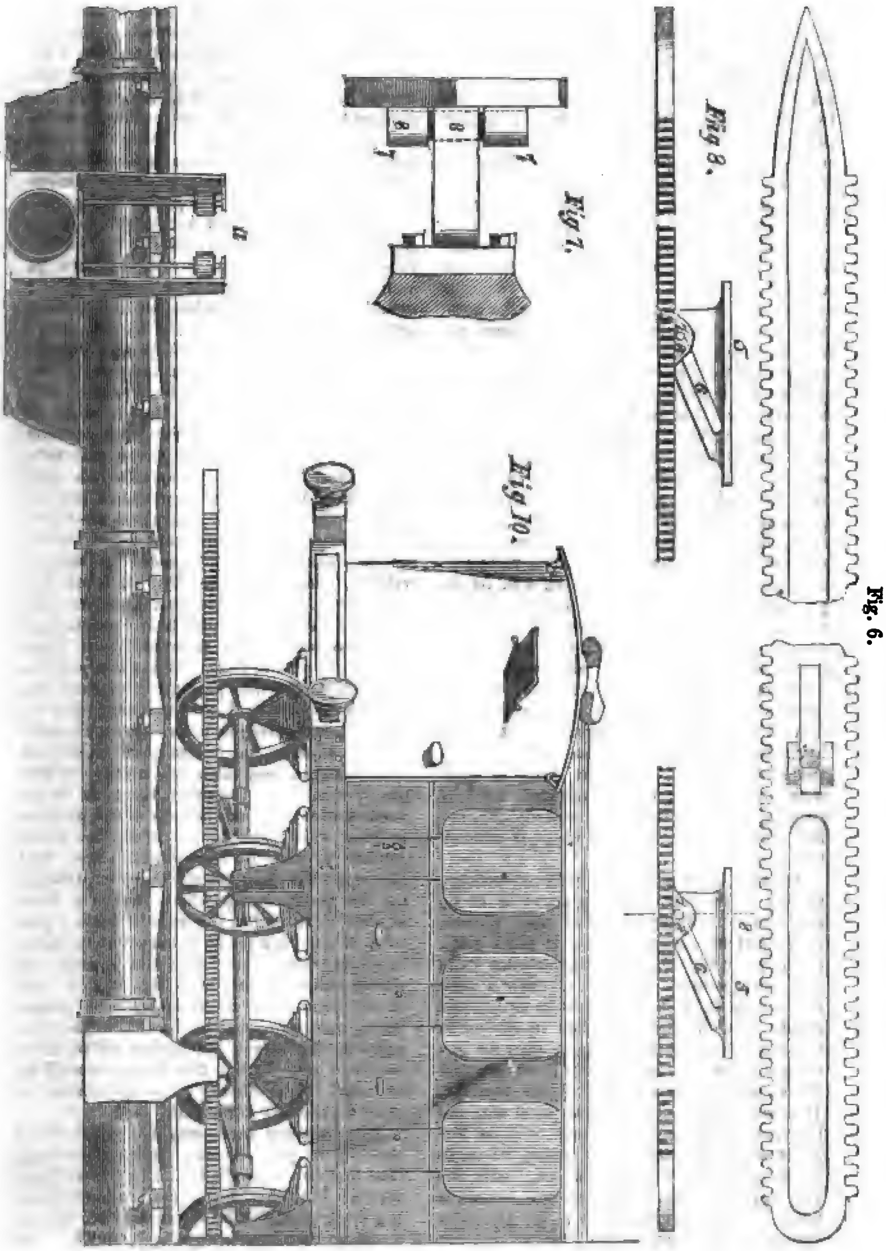


Fig 7.
Fig 8.
Fig 10.
Fig. 6.

be made to fit as nearly air-tight as possible into this tube, having attached to it behind a long bar having cogs or teeth along both its edges, to correspond and fit the cogs or teeth of the pinions. Fig. 3 is a side view of this piston and piston-rack; *l l* is the piston head, and from thence rearward the line of cogs and teeth; *n* is a wheel or roller placed near the centre of the rack, to support it in its proper place, and to obviate friction in its progression. Fig. 4 represents an end front view of the piston, and fig. 5 a section of the rack portion. The cogs are not continued throughout the whole length, but along the lower part there is a plain piece, as shown, which, at the piston end, declines or approaches the bottom, forming a small inclined plane, as shown at *p p*. This piston-rack is to be sufficiently long to reach two or more of the pinions in the tube, so that it may never be entirely free, that is, will touch one before it leaves another. The pinions then being so arranged that they project at about the middle or horizontal diameter of the tube, and the rack being arranged in the same position with respect to the piston, it follows, that when the piston is placed in or allowed to pass along the tube, the rack or cogged edges will act upon, and be in gear with that part of the pinion at *d*. If, therefore, a vacuum be formed by pumping out, or exhausting the air from the front of the piston in the usual and well-known manner, by air-pumps worked by steam-engines or otherwise, the pressure of the natural atmosphere will urge this piston onwards towards the vacuum, and consequently the rack with it, and that being in gear with the pinions, cannot advance without turning them as it passes, and also, therefore, that portion of them which is *outside* the tube.

To the under part of a railway-carriage, in any convenient manner, there is to be attached a similar rack to the piston-rack, (but without the piston or plain part, as shown in fig. 3), which the inventor calls the carriage-rack. A plan of such a rack is given in fig. 6, a front view in fig. 7, and a side view in fig. 8. The front end is tapered or pointed, to render easy its entrance between the pinions; *s s* are the places where it is attached to the carriage. It is made precisely to correspond with the internal or piston-rack, and will be the exact width the pinions are apart, so as to be in gear like the piston rack, with the two opposite pinions at one and the same time. This carriage rack is also the length of the other, so that it may reach two or more of the pinions or pairs of pinions at once. Fig. 9 exhibits a transverse section of the tube, with opposite pinions; also a section of the carriage rack at *t t*, and a section of the piston rack at *u*, both racks being in gear respectively with the pinions at v v v v. The boxes or projections, w w w w, which contain the lower part of the pinions, have a hollow or chamber, to permit the pinions to revolve freely, but are made to fit on to the tube air-tight, having but one opening into the inner part or chamber, at *j*, through which the spindle of the pinion passes. To admit of the pinion being put into its place, the box must be made to separate and to go together at the dotted lines by bolts, shown by the letters *y*, and air-tight. To make the passage of the spindle from exterior to interior of the tube air-tight, when required to be so, there is upon the spindle of the pinion (below the upper cogged part) a conical or bevelled shoulder, at an angle of about 45°, as shown at *k*; and the upper edge of the passage through which the spindle passes, *j*, is bevelled, to correspond with the conical part of the spindle, so that when down in its place, the conical part of the spindle may fit, and become air-tight, in the manner of the common valve known by the name of the 'spindle or conical valve.' That the pinions may be lifted up, and therefore the valve part also from its seat, the pivots are made long enough, and the chamber in the tube and box large enough, to permit of it. When the pinions are lifted up, a free passage is allowed for the ingress of air into the tube; and to make these passages, under these circumstances, as large and free as possible, several side passages may also be made. When the piston rack is within the tube in its desired situation, and the cogs of the pinions in gear with those of the rack, the lower surface or end of the pinion cogs, will rest upon the plain piece (before explained) on the piston rack, which makes a kind of shelf or ledge for the cogs or teeth; and thus, if this rack be so arranged as to move in a line rather higher than the pinions are placed when down (as in fig. 10), it will cause them to be lifted up when it passes them, thus avoiding the friction of the air-tight shoulders, and permitting air to enter into this tube during this action as may be essential to the efficacy of the apparatus, as will be presently explained.

The carriage rack may be attached to the under part of any railway carriage (the first carriage of a train) by any suitable means; but Mr. Pilbrow prefers the following mode of doing it, which will be understood by reference to figs. 6, 7, and 8. The two parts, 5 5, are firmly fastened to the under part of the carriage, or to a piece of

timber supported by and suitably attached to the axles of the carriage; in the under part of these supports is formed a groove or slot, 6 6; and upon the rack are fixed suitable projections, 7 7, through which bolts, 8 8, are passed, going also through the slot in the support. These bolts, then, resting at the bottom of the slots, support the rack in the horizontal position shown, a little lateral play being allowed; by this arrangement, the rack, if suddenly meeting with any resistance from any of the pinions in passing them, (the momentum of the carriage urging it on,) would cause the rack to be pushed up these slots, and thereby getting above the pinions, (if made sufficiently effective for this purpose,) and so enable it to pass the obstruction without concussion to any part of the apparatus outside the tube.

The manner of working the apparatus is as follows:—A pipe or tube, as before described, of sufficient diameter, being laid along in a hollow between the rails of a railway, and being exhausted of air by suitable means, and having the pinions arranged as described at intervals throughout its length; the piston, with its rack attached, is placed in this tube at the farther end from where the air has been or is being exhausted or withdrawn; the piston rack is put in gear with the pinions *inside the tube;* a railway carriage, having a carriage rack attached to it, as described, is placed upon the rails, as shown in fig. 10; this carriage rack being also in gear correspondingly with the upper part of the same pinions (that is to say, the relative position of each rack being the same, the piston rack being precisely under, and matching end to end with the carriage rack); the one rack cannot then move backwards or forwards without turning the pinions; and these being also in gear with the other rack, that must move also, and in the same direction. Therefore, if the vacuum has such an effect upon the piston that it advances, then will the rack upon the carriage be affected in the same way, by and through the medium of the pinions, and will advance also, and keep its relative situation exactly with the other. The racks being long enough to reach, as described, at least two pairs of pinions at one time, the next in advance is acted upon before the one acting has ceased, and, therefore, as long as the power applied continues, and the piston advances, the carriage will do the same to the end of the tube; neither arriving before or after the other, but together, as they cannot separate, nor can one move or stop without the other.

As it is necessary and important that the atmosphere should be admitted as nearly behind the piston as possible, the pinions are lifted up by the advance of the piston rack, and the air will enter through the space allowed by the lifting of the conical or flat portion of the arbor or axis of the pinion, as described; so that there would always be at least two or more such passages open, as the rack acts upon the one before it leaves the other. After the rack has passed by, the pinions by their own weight fall into their places, and thus make an air-tight tube ready for the next exhaustion, when, if an air pump be set to work at the other end, and the *direction* of the piston and rack changed, and placed again as before into proper gear, the carriage would *return* in like manner.

Fig. 10 represents a longitudinal elevation of a portion of an atmospheric railway of this description, crossed, *on a level*, by a roadway, and another line of atmospheric railway; from which it will be seen that there is plenty of space between the pairs of pinions for the crossing, and that the mains being sunk beneath the surface of the ground, or under the sleepers of the rails, they will be entirely out of the way, the carriage rack passing on from one pinion to another over such roads, without interfering. It will be obvious also, that where it may happen that two tubes are required to cross each other, one will pass beneath the other, the upper one keeping its level course, the lower one taking a gradual descent or dip under it, and the pinions keeping their necessary level at the upper part by being lengthened, at such a locality, in the axes and supports, as shown at *a*. The first, or rack carriage, of a train, is shown advancing upon this cross line as it would appear just previously to its taking the pinions at *a*.

As there will not be on this plan, even in a single line of rails, any discontinuance of the main tube but at a place arranged for trains to meet and cross, which will always be at a *station*, (and for general purposes probably not less than twenty miles apart,) it will be only at such places that the main would require any kind of valve to close its open end. The end of the main would simply require a disc of iron or wood placed against the open end, with a little composition to make an air-tight joint. When the vacuum is to be made by the air pump, the disc or valve will fall or be pushed aside when the piston arrives at the end, and will require no more attention, excepting being replaced, or closing by the time this engine is again required to work.

The piston would, when it arrives here

either partially or wholly leave the tube, after displacing the disc or door by its remaining momentum, and the train with the carriage rack would pass on, and take one of the sidings, and be stopped by the attendants by brakes as usual; but the operation of the stopping would have been begun before arriving here, the train now only moving slowly, and with sufficient momentum to carry it to the place required, or middle of the siding. When the piston and rack reach the end of the main, and are out or withdrawn, it is proposed that there shall be placed, at each of the two ends of the mains, a receptacle or trough, mounted upon four wheels or rollers, so that the piston coming on to it, could be immediately removed for inspection, &c., and another piston, newly greased, &c., brought and placed (by the same means) with its head in the tube ready for the next returning train. The trains having both arrived, each train would be (by any suitable means) urged on to the commencement of the opposite main, where the fresh pistons having been already inserted (and held by any convenient contrivance) and the vacuum formed, the carriage rack coming into gear with the first pair of pinions, and the piston released, the train would start on its journey. Thus the pistons would never leave the main, or enter another, but at a very slow pace, and at a place for stopping. The same piston would not be required to go on the whole journey, but a fresh one every 20 miles, leaving the other to be examined, &c.

Mr. Pilbrow observes that ropes or bands of leather may be substituted for the racks—"varying the surface accordingly." For our own parts we are inclined to think that it will ultimately be found that neither cogged-wheels nor racks are requisite for the proper working of this system; and that the propulsion of the carriages may be effected by the simple adhesion of plain surfaces; that is to say, that the tube piston, the pinions, and carriage piston, may all be plain, and that by the friction of each against the other, the desired progression will be produced. Should this prove to be the case, we shall then but have a repetition as regards the atmospheric system, of the same thing which took place on the first introduction of railways. Nobody, at one time, supposed that a plain wheel would move forward on a plain rail; or that it could be made to advance otherwise than by the help of cogs or grippers of some sort or other. A single trial of the force of simple adhesion dispelled the illusion, and cogs and grippers were no more heard of.

Mr. Pilbrow calculates that the "total saving (from his system) for 100 miles per annum in working, as compared with the estimated cost by the present atmospheric system," would amount to not less than 58,303*l*. The correctness of this estimate may possibly admit of question; but that there must be a very considerable saving resulting from the supercession of so many of the expensive and wasteful adjuncts of the present system, cannot reasonably be doubted. The following observations by Mr. Pilbrow, touching one point of this question of economy, are too important to be omitted.

"The reason why a less number of carriages will be required on this plan is, that there being no long valve here, the leakage will be so diminished that it will amount to less in ten miles than now in one; it is estimated that now the leakage equals 5-horse power per mile,* and therefore, should there be but one engine to ten miles of main, 50-horse power out of the 100 would be lost for leakage alone; so it is found absolutely necessary to have one engine every 3 miles, thus reducing the loss to 15-horse power out of the 100. Why the pinion-valves as proposed will not leak so much as the long valve is, first, because the surfaces are ground truly, and are pressed together by the weight and fall of the pinion (and the more used, the better they will stop); and secondly, on account of the small quantity of surface or space *that can leak*, the proportion being as 1 to 20 between the two systems, for the pinion valve or seat being but about 9 inches in circumference at the aperture where the air is admitted, and there being only two of them to every 30 feet of main = 1·5 feet, whereas, the present long valve would be the whole *thirty feet* exposed, and liable to leakage; hence, even were the pinion-valves to leak as much as the long valve, *surface for surface*, this plan would only leak $2\frac{1}{2}$-horse power instead of 50-horse power, in 10 miles."

Mr. Pilbrow's patent and pamphlet include also a scheme of a pneumatic

* See Mr. Samuda's evidence before the Committee of the House of Commons. Mr. Bergin, in his evidence, said 5 or 6-horse power per mile, &c., but doubtless this will be found underrated for extensive practice.

telegraph (to be combined with his atmospheric railway;) dependent on the rise and fall of columns of mercury, when acted on by air exhausters; but in this we do not see anything new. Such a mode of telegraphic communication has been often before proposed.

THE "GREAT BRITAIN" STEAMER.

We mentioned in our last that on a second trial on Thursday the 12th inst., this Leviathan was at last liberated from Cumberland Basin, and tugged out to Kingroad, the seaward harbour of Bristol. The following account of some subsequent experiments made with her, is given by a correspondent of the *Times*.

"The steam was then got up (on arriving at Kingroad), and at half-past 11 o'clock the screw-propeller was put in motion. It has been objected against the use of the screw in many steamers, that its action causes them not only to steer very badly, but renders it necessary to have more men at the wheel than under other circumstances, the steering being extremely laborious. The *Great Britain*, however, steered 'like a boat' with one or two strokes of her wheel, and came round with the helm at 30 degrees in a circle of less than half a mile in diameter. The superintending engineers, Mr. I. K. Brunel and Mr. Guppy, of course, in starting, did not intend that this, the first experiment, should be one of full speed, as no new engines can be expected to have properly come to their bearings until after they have been worked for some time; and accordingly directions were given to Mr. H. S. Harman, the engineer-in-chief, to start her with six revolutions only, at which she made about four knots. On passing Portishead, at 12 o'clock, the revolutions were increased to 9¾ per minute, when she made a 6¾ log; 10¼ revolutions gave a log of 7 knots; 10½ revolutions a rate of 7½ knots. The steam was kept at this point for some time, and then increased to 12 revolutions, when she gave 8 knots as her rate of speed. At this period, being then near the Holmes, the experiment of turning her round with the helm hard down was tried; she came round in nine minutes, making a circle of rather more than half-a-mile in diameter. She was then tried a second time, with the helm at only 30 degrees, when she came round in a most beautiful manner in six minutes, and in a less distance. When going the straight course the stupendous mass answered her helm most readily, taking not more than one spoke of the wheel, and requiring only one man at it. In returning homewards the speed of the engines was gradually increased to 13 revolutions, at which she gave 8¼ knots, and to 16 and 16½ revolutions, when she went through the water at 11 knots, against a strong head wind, passing easily the *Sampson*, the fastest paddle-boat out of the port. At this rate of going the steam was cut off by the expansion-valve at 1 foot, or one-sixth of the stroke, six of the fires not having been lit during the whole trip. The engines worked perfectly smooth, and without the slightest vibration or tremor being felt in any part of the vessel. The screw-propeller during these experiments was not fully immersed, the ship's draught of water abaft being only 14 feet 6, and about 12 feet forward, and no doubt existed in the minds of any of those present versed in such matters, that upon the next experiment, or when the revolutions of the engine are increased to 20 in a minute, a speed of from 12 to 13 knots can be easily obtained. When the vessel was going 11 knots the screw-propeller was only going 12, making the slip or loss only one-eighth and a third per cent., and which slip will of course be diminished when the screw-propeller is entirely immersed. When going at her best speed there was no swell whatever under the bows, her stem cutting through the water just as the fastest Thames boats do. The whole experiment lasted five hours; and in every particular the vessel realized the most sanguine expectations. It was supposed that the noise of the chains passing over the drums to give motion to the screw by which she is propelled, would be so great as to prove an annoyance to the passengers. This, however, has been completely avoided, the chains and wheels upon which they work revolving without noise, and what is still more desirable, there is a complete absence of vibration in the ship."

DIVERGING AND CONVERGING SERIES—SOLUTION OF "IVER M'IVER'S" QUESTION, VOL. xli., P. 334.

1st. Let $x^3 - y^3 = a^3$ and $x\,y = b^2$; $\therefore$ $y = \frac{b^2}{x}$; $\therefore x^3 - \frac{b^6}{x^3} = a^3$, or $x^6 - a^3\,x^3 = b^6$.

Solving this quadratic, we obtain,

$$x = \left(\pm\tfrac{1}{2}\sqrt{(a^6+4\,b^6)} + \frac{a^3}{2}\right)^{\frac{1}{3}};$$

and this value of x is always possible.

Now suppose $x = \tfrac{1}{2}(z + v)$,
And $y = \tfrac{1}{2}(z - v)$,
Then $x + y = z$,
And $x - y = v$,

$$\begin{aligned}
&\text{And} \quad x\,y = \tfrac{1}{2}(z+v) \times \tfrac{1}{2}(z-v) = \tfrac{1}{4}(z^2 - v^2) = b^2;\\
&\text{Hence,} \quad v^2 = z^2 - 4\,b^2, \text{ and } z^2 = v^2 + 4\,b^2;\\
&\text{Also,} \quad x^3 = \tfrac{1}{8}(z^3 + 3\,z^2\,v + 3\,z\,v^2 + v^3),\\
&\text{And} \quad y^3 = \tfrac{1}{8}(z^3 - 3\,z^2\,v + 3\,z\,v^2 - v^3);\\
&\therefore \quad x^3 - y^3 = \tfrac{1}{8}(6\,z^2\,v + 2\,v^3) = a^3;
\end{aligned}$$

Or, $3\,z^2\,v + v^3 = 4\,a^3$; hence, by substitution, $3\,v^3 + 12\,b^2\,v + v^3 = 4\,a^3$,

Or, $v^3 + 3\,b^2\,v = a^3$;

and this cubic equation belongs to the reducible case of *Cardan's* rule, because the second term is positive.

Now suppose we have the cubic equation $v^3 + 3\,b^2\,v = a^3$ to find v, by reversing the process we have,

$$x\,y = b^2 = \tfrac{1}{4}(z^2 - v^2).$$

Hence,

$$\begin{aligned}
v^3 &= x^3 - 3\,x^2\,y + 3\,x\,y^2 - y^3.\\
\text{And } 3\,b^2\,v &= \quad 3\,x^2\,y - 3\,x\,y^2\\
\therefore v^3 + 3\,b^2\,v &= x^3 - y^3 = a^3
\end{aligned}$$

And $x\,y = b^2$.

Hence, $v = x - y = x - \frac{b^2}{x}$

$$= \left(\pm\tfrac{1}{2}\sqrt{(a^6+4\,b^6)} + \frac{a^3}{2}\right)^{\frac{1}{3}} - \frac{b^2}{\left(\pm\tfrac{1}{2}\sqrt{(a^6+4\,b^6)} + \frac{a^3}{2}\right)^{\frac{1}{3}}};$$

and this value of v is always possible.

2nd. Let $x^3 + y^3 = a^3$, and $x\,y = b^2$, then, in the same way as above, we find

$x = \left(\pm\tfrac{1}{2}\sqrt{(a^6-4\,b^6)} + \frac{a^3}{2}\right)^{\frac{1}{3}}$; and this value of x will be impossible when $4\,b^6$ is greater than a^6.

$$\begin{aligned}
&\text{Again,} \quad x^3 = \tfrac{1}{8}(z^3 + 3\,z^2\,v + 3\,z\,v^2 + v^3)\\
&\text{And,} \quad y^3 = \tfrac{1}{8}(z^3 - 3\,z^2\,v + 3\,z\,v^2 - v^3);\\
&\therefore \quad x^3 + y^3 = \tfrac{1}{8}(2\,z^3 + 6\,z\,v^2) = a^3,\\
&\text{Or,} \quad z^3 + 3\,z^2\,v = 4\,a^3;\\
&\therefore \quad z^3 + 3\,z\,(z^2 - 4\,b^2) = 4\,a^3,\\
&\text{Or,} \quad z^3 - 3\,b^2\,x = a^3,
\end{aligned}$$

a cubic equation, which will fall under the irreducible case of *Cardan's* rule, when $(b^2)^3 > \frac{a^6}{4}$, or when $4\,b^6 > a^6$, the same limit as we obtained from the given equations. And by reversing the process we transform the equation

$$z^3 - 3\,b^2\,z = a^3$$

into the given equations $x^3 + y^3 = a^3$, and $x\,y = b^2$, where x and y and consequently z may be found subject to the above-mentioned limitations; and in all probability it might have been from solving the equations $x^3 \mp y^3 = a^3$ and $x\,y = b^2$, that the celebrated rule of *Cardan* was first discovered.

GEORGE SCOTT,
Private Teacher of the Mathematics.

5, Winchester-row, New-road,
November 22, 1844.

HANKIN'S PEDIMECHAN.

Sir,—In your publication of the 30th of November appeared an article, showing the principle of the spiral propelling motion, known as Hankin's Pedimechan, and sold by Messrs. Deane, Dray, and Deane, of 86, Chiswell-street. Having purchased from them one of these vehicles, I made trial of it on Wednesday, in company with the inventor, in another. We proceeded from Chiswell-street, up the City-road, through Pentonville, up the New-road, round the Regent's-park, from thence into Hyde-park,

and thence to Bayswater, and back to Chiswell-street—together from fourteen to sixteen miles. We were delighted with the ease and expedition with which we accomplished the distance. It has fully answered my most sanguine expectations; and I trust that these facts, together with the recommendation you have given of it, will be the means of promoting the sale of this extraordinary novelty.

I remain, sir, your obedient servant,

H. HINTON.

119, Bunhill-row.

MEMOIR ON THE INFLUENCE OF LIGHT, AIR AND MECHANICAL EXCITATION, ON ALE AND PORTER WORTS UNDER AN ELECTRICAL AND ELECTRO-CHEMICAL DECOMPOSITION, WHEN CONDUCTED ON BENTLEY'S SYSTEM OF STONE SQUARES. BY WM. W. BOTTERILL, PROFESSOR, TEACHER AND PRACTICAL BREWER, BURNLEY, LANCASHIRE.

Light has no effect or influence over fermentation. The proof of this is, that there exists no difference in the quickness of activity, either during day or night when the temperature is the same, and the electrical position is the same. But on the application of atmospheric air there is exhibited a peculiar and perceptible alteration. In confined cellars where fermentation is conducted, sometimes a circumstance similar to a vacuum or outward pressure may be perceived upon a vessel of wort in active fermentation; under these circumstances the fermentation proceeds rapidly, and appears to be subjected to a harassing vocation—presenting to the eye a perfect specimen of a wort under the influence of putrefactive fermentation. An electro-chemical decomposition is taking place, instead of a purely electrical one; carburetted-hydrogen gas is given off, instead of carbonic-acid gas, in the form of a thin head of yeast with *large bubbles* constantly forming and *breaking*. Pass now a current of atmospheric air into the cellar and direct it across the fermenting wort, and in ten or twenty minutes that harassing action will have ceased, and the fermentation will proceed *slowly*, *easily* and *regularly*.

There is no doubt, but that every division of the laws of fermentation consists, when properly conducted, of a *pure electrical action*, namely: from the first change of the starch of the malt into dextrine, the diastase of the malt acting the part of one peculiar acid, is again changed into another to complete the change of the *dextrine* into sugar. The first change being the result of the *positive*, and the second, the result of the *negative* electrical action, and which I call the *saccharine fermentation.*

The next division of the laws of fermentation—is that which governs the conversion of the sugar, the result of the above action, into an alcoholic beverage.

Soon after the application of the ferment to the proper extract of malt, there will have taken place a change—a portion of the compound of the extract will have combined with a portion of the compound of the ferment, and formed lactic acid. This principle acts the part of the next required acid, and creates the *positive electrical action*, and re-forms for itself aldehydic acid, with the already formed alcohol, and a portion of the hydrogen from the compound of the wort or extract. This acid, then, acts the part of the second excitor, producing through the *negative electric action* a complete alcoholic beverage. And from an improper extract, an alcoholic, aldehydic, and acetic compound, or in other words an acid, sickly, disagreeable beverage. Throughout the above proper stages of electrical action, carbonic-acid gas will be set free, and an azotized principle will be formed, namely, ferment, yeast, or barm. This I call the *vinous fermentation.*

All these stages of electricity are demonstrable with proper instruments, and a proper manipulation; and it is evident from experiment, that a pure extract will produce a pure vinous fermentation; on the other hand, an impure extract, from impure manipulation, or from improperly made malts, will cause an action very irregular, producing carburetted-hydrogen gas, instead of pure carbonic-acid gas, proceeding wholly from a want of oxygen to meet the excess of nitrogen and carbon—a consequent attendant in all glutenous, and more particularly, albumenous solutions. If the extract be made improperly, from *properly* made malts, it will be a *glutenized* solution, but if the extract be made from *improperly* made malts, then the solution will contain albumen, in place of gluten, and consequently, there will exist more azote gas; and such worts, or solutions, will have a greater tendency to run into aci-

dity, and eremacausis, unless there is brought about a connexion between the yeast or ferment, already formed, and the oxygen of the atmosphere; when this is effected the yeast takes up the oxygen from the atmosphere, to the amount of its chemical affinity, and becomes oxidized. The next agitation made use of—a peculiar and essential part of the manipulation, when wort is fermented on Bentley's system of stone squares, combines the oxidized yeast with the wort, when it is again let into the body of the fermenting mass, and the oxygen thus taken up, supplies the place of that of the water, electrically and chemically decomposed.

When an electro-chemical decomposition is in actual operation, the laws of nature will be obeyed; if there be not sufficient oxygen in the compound to meet the contingency, or demand of the nitrogen and carbon, then it must undoubtedly be taken from the water, and by doing that, it sets free more hydrogen than is required in a proper electrical action, and more than ought to be set at liberty. Hydrogen acts the part of a check to the rest, or may be called a *sustaining principle of the whole.* But when there exists, on the part of the wort or general compound, a natural desire to run into too great an action, arising out of an improper combination of the different compounds, in which there exists too little of one principle and too much of another, then there will have taken place a broken or improper action, and consequently it is an electro-chemical decomposition, instead of an electrical one, the only necessary and required action during a vinous fermentation; and this improper action, namely, an electro-chemical decomposition, will continue, until oxygen can be communicated in the way I have already described.

What I have so far held out is governed by that well-known law in electricity, "that too great an excess of acid, or action, will cause a compound one, an electro-chemical decomposition," and gases are emitted that should be retained, in place of a pure electricity.

Liebig observes, "that the formation of yeast depends upon oxygen being appropriated by the gluten in the act of decomposition, but it has not been sufficiently shown whether this oxygen is from the water, the sugar, or the gluten itself, whether it combines directly with the gluten, or merely with the hydrogen, so as to form water."

I have found that a pure malt wort,—the first mash made at the *first*, and the second made at the *second diastases heats,*—will produce a pure and regular fermentation, without receiving more oxygen from the atmosphere than a constant closed room will afford, and as I have already stated, an impure wort will require a current of air passing over its barm, until it has reduced itself to 1·0360 specific gravity—the position where the positive electrical action turns to that of the negative.

From this, then, it is very clear, that it receives its oxygen, *when* the wort *is pure*, from its own *bodies* only, and not from the gluten alone, and that the proportion of oxygen should be, as shown in the following analysis, a little above the carbon, with which it combines; but when the wort is impure, it is necessitated to receive its oxygen, both from its own bodies and from the atmosphere, so as to be able to effect the desired metamorphosis. From this analysis, it also appears clear, that the amount of action depends upon the amount of nitrogen in the compound. And on this hangs all electric and electro-chemical decomposition of vegetable matter, if the compound be a sugar solution, with a small charge of gluten; which is always the case when a proper division of the diastases heats are employed, and can be effected without partially setting the goods and extract, or in other words, without the fear of converting the extract into gum, instead of proper proportioned saccharine and glutenous solution. The following analysis will show what I have and shall hereafter illustrate.

	1st. A Proper Extract. By Wm. W. Botterill.	2nd. A Malt Sugar Extract. By Prout.	3rd. Glutenized Extract. By Wm. W. Botterill.
Carbon	40·58	36·2	44·97
Hydrogen	7·20	7·09	7·32
Nitrogen	3·63	..	7·25
Oxygen	48·59	56·71	40·46
	100	100	100

4th. An Albuminous Extract.

By Wm. W. Botterill.

Carbon	46·37
Hydrogen	7·47
Nitrogen	7·33
Oxygen	38·83
	100

What I have already stated, namely, that a proper extract will contain oxygen sufficient within its own body to complete its own metamorphosis, is here illustrated. In the first analysis of "*a proper extract*" it will be seen, that there exists a little more oxygen than carbon, and than is required to complete its electrical changes. In the second "*a malt sugar extract*," it will be seen, that there exists too large a quantity, and no nitrogen. When this extract is fermented, a large quantity of yeast will be produced, and a very active fermentation will be the result. Beer produced from it will be very clear, and will taste thin and watery, but will not keep; it preys upon itself and gradually becomes very sour. This solution depends upon the yeast or ferment employed for its nitrogen. From the third, *a glutenized extract*, a lagging fermentation may be expected, with a bluish yeast at the beginning, and it will continue to look unhealthy until the negative electrical action has taken place. From the fourth, *an albuminous extract*, may be expected a regular, determined, inert fermentation, and one that requires an experienced brewer to turn and superintend; its appearance will be very blue, large blebs will arise in place of yeast, and a complete electro-chemical decomposition will have taken place, arising in this, as in the third, from the want of a proper quantity of oxygen to meet the demand of the carbon and nitrogen of the compound, and that of the ferment employed; this want of oxygen may be produced as described at the beginning of this memoir.

A great mass of reasoning is yet necessary to complete a subject like this. It is a subject that embraces the *ranges of temperature and their laws*.

Heats between 40 to 110 degrees may be used with equal advantage in producing good beer, provided the *law of range*, which governs each division, and sub-division, within and amongst the degrees between the above-named temperatures, and the same law of range, may, by another arrangement, be applied with equal success in vinegar making. From this, then, it is evident, that that law of range should be known to the brewer of ale which governs his department, and it is also necessary that he should know that there is thrown up *three* descriptions of yeast from a fermenting vessel during the time wort in it is under the action of decomposition, and he should always be able to distinguish that which will best answer his purpose.

The object of this Memoir is to show that *a constant temperature vault* will not, in ordinary cases, be advantageous, and it also illustrates the advantage of a *mash-tub attemperator*.

ERASURE OF BLACK LEAD MARKS BY CAOUTCHOUC — ANSWER TO ENQUIRY, p. 380.

Sir,—In answer to the question of J. G. T., I beg to submit, for his information, that the only chemical agency available in the erasure of black lead marks by caoutchouc, is that of electricity, excited by the friction, to the dissolving of the gum, so far as is necessary to admit of the incorporation with it, of not only the carburet of iron, but any other extraneous matter with which it may come in contact;—an action which continues until the particles of matter and the degraded gum are formed into a depending mass, and at last becomes detached.

J. G. T. will be able readily to satisfy himself, by experiment, that the above is correct. Caoutchouc is organic matter, containing, besides the organic constituents, a small proportion of several salts; and if the particles rubbed off are decomposed, the iron will be obtained pure.

I cannot, however, say the pure gum does not contain salt of iron in some form: that must be proved by a separate experiment.

I am, Sir, yours, &c.,

T. H. B.

THE SCREW EXPERIMENTS WITH THE "PIGMY GIANT."

Sir,—"Scrutator Mechanicus," in his communication of the 7th inst., confounds the calculated with the nominal horse power. Perhaps he will be good enough to forward to the *Mechanics' Magazine* the area, pres-

sure on, and velocity of the pistons of the *Infant Prince* and the *Mystery*, with the speed and submerged midship section of the latter, and their consumption of fuel. If "Scrutator Mechanicus" had allowed 17 feet for the submerged midship section of the *Infant Prince*, and 10 feet for the *Pigmy Giant*, he would have been nearer the truth.

It appears that "Scrutator Mechanicus" does not understand what he has with so much confidence been writing about. If he does not call the rollers the revolving pistons, what does he refer to?

I may state that one of the roller rotatory engines (the one that has been at work the longest,) has been, for upwards of two years, at work at a customer's, giving him the highest satisfaction, requiring no repairs, and not very likely so to do for a considerable time to come; and when it does, they will be of a very trifling nature.

"Scrutator Mechanicus" remarks on the velocity of the pistons. Experiments are about being made, the object of which is to raise the present standard of 1,000 feet per minute to 3,000 or upwards. Let "Scrutator Mechanicus" ruminate upon this.

I am, Sir, yours, &c.,

JOHN BEALE.

MR. SCOTT'S THEORY OF PARALLEL LINES —K. L. IN REPLY TO KINCLAVEN.

Sir,—Some accomplished reviewers are said to have attained to such perfection, that they do not require to read the works on which they are to give judgment. Of this highly gifted and no doubt inspired class, your learned correspondent Kinclaven affords a most promising specimen: for no one who examines his epistle in No. 1105, would be apt to believe that he had read either Mr. Scott's papers or mine. He commences with a complaint that, in No. 1100, I had fallen upon Mr. Scott before his demonstration in No. 1088 was finished. But this is perfectly groundless. Mr. Scott himself had given it as complete; for he has neither concluded with any *noli me tangere*, nor given the least hint that he intended either to add or amend; so, after a lapse of nearly three months, I might surely reckon him fair game. But of what use was farther delay? Mr. Scott in his subsequent article in No. 1102, has done nothing to remedy the defect which I had pointed out.

Another woful complaint is, that I have employed the term *parallelogram*. But here again, like many good folks, Kinclaven's zeal has fairly outrun his knowledge; because this well-known term does not, as he would insinuate, assume anything regarding the 12th axiom; for since each of the two figures, which for brevity's sake I had so named, has its opposite sides and angles respectively equal, it is evident that each diagonal, if drawn, would make equal angles with the opposite sides, which, by prop. 27, proves them to be parallel, and so comes up to the usual definition of a parallelogram. This term being, therefore, perfectly legitimate, I shall continue to use it, though merely to avoid circumlocution.

As to Kinclaven's calling upon me to prove that if the angles of the first parallelogram were acute, the unknown angles of the second would be still more so—I need only observe that if ever he had read my very short paper, with which he is so seriously displeased, he would have seen that I have there given Mr. Scott the credit of having proved that point already: for that is what he has proved, and by no means that the angles of a parallelogram are equal to four right angles. In these circumstances, it would be highly improper in me to trespass on your pages with any other proof of a thing so childish and useless; for Mr. Scott has failed in turning it to any account. Neither is it in the least necessary, as Kinclaven supposes, first to have proved that the angles of every parallelogram should have the same amount. Indeed, I suspect this last, need scarcely be attempted without previously showing, as Mr. Meikle has done, that triangles whose areas are equal have the sums of their angles equal; and that if in one triangle the angles differed from two right angles, so they would in every triangle, and the difference would always be proportional to the area. Probably Delta, in concluding, meant that these theorems being but new in this department of geometry, may yet have their proofs so simplified as to be admissible in an elementary treatise.

Kinclaven's assertion, that I object to

some demonstrations merely because they are *indirect*, is a pure fiction of his own. Nothing of the kind occurs in my paper. On the contrary, I have always reckoned the indirect method the most likely to succeed. Such too was the opinion of the late eminent Sir James Ivory; and Mr. Meikle, who disputed with him on various subjects, perfectly agrees in this, and has, in Jamieson's Journal, as before cited, adduced several instances of signal failure, where *direct* reasoning has been employed by some of the greatest mathematicians.

The expression which Kinclaven has so kindly put into my mouth, that "Mr. Scott makes a false supposition," was never used in my paper. I found no fault on that score. But in thus resorting to so many fictions, Kinclaven seems to act on the good old priestcraft maxim, that the end justifies the means. The objection which I really made was, that Mr. Scott had virtually assumed the whole affair; and I may now add, that his more recent paper does not come nearer the mark; for he has still failed to give so much as the shadow of any proof of the most important point of all, namely, that the angles of a triangle can never be less than two right angles. In short, the leading idea of all his procedure seems to be, that if he can only reason so as to arrive at a contradiction of any kind, he will be warranted to conclude that the angles of a parallelogram are equal to four, or those of a triangle to two right angles. Of this we have a further example in No. 1102, where Mr. Scott, on resuming his subject, takes for granted that a parallelogram, which has its sides given and all its angles equal, may also have those angles variable; and, by reasoning upon such data, he finds that they involve a contradiction. But the obvious conclusion from this contradiction is, that the proposed parallelogram cannot have its angles *variable*. He might just as well infer from it a fall of rain or snow, as that the angles of a triangle are equal to two right angles. If Mr. Scott's readers, myself included, would swallow any such thing, under the name of geometry, we would well deserve to be commended as the most docile of simpletons. The reason why I passed over Mr. Scott's 1st and 2d propositions without remark was, that they had previously been given by other authors, particularly Colonel Thompson, and they do not seem liable to any objection.

All Mr. Scott has done only amounts to a proof that the angles of a triangle cannot exceed two right angles. But this had often been done by others. Without something else, it is of no value; and, at any rate, it is not indispensible to the proof of Euclid's axiom.

If Kinclaven intends anything further on the subject, I have to request that he would keep to something like the merits of the question, and not again encumber your pages with an irrelevant tirade of fictions, which only proves his cause to be desperate.

K. L.

THE ARTESIAN WELL OF GRENELLE.

THE most remarkable example of an Artesian well is that recently formed at Grenelle, a suburb at the south-west of Paris, where there was a great want of water. It cost eight years of difficult labour to perforate. The surface at Grenelle consists of gravel, pebbles, and fragments of rock, which have been deposited by the waters at some period anterior to any historical record. Below this layer of detritus, it was known to the engineer, by geological induction, as well as previous experience, that at Grenelle marl and clay would be found, instead of the limestone which generally forms the immediately subjacent stratum. He was aware that he had to bore about 440 yards' deep before he should arrive at the sheet of water which flows in the gravel below the limestone, and supplies the wells of St. Ouen, St. Denis, and Stains. Underneath the marl and the clay the boring rods had to perforate pure gravel, plastic clay, and finally chalk, which forms the bottom of the general tertiary basin, as we have seen. No calculation from geological data could determine the thickness of this stratum of chalk, which, from its powers of resistance, might present an almost insuperable obstacle. The experience acquired in boring the wells of Elbeuf, Rouen, and Tours, was in this respect but a very imperfect guide. But supposing this obstacle to be overcome, was he sure of finding a supply of water below this mass of chalk? In the first place, the strata below the chalk possessed, as we shall see, all the necessary conditions for producing Artesian springs, namely, successive layers of clay and gravel, or of

pervious and impervious beds. M. Malot confidently relied on his former experience with Grenelle. M. Arago had shown that the water of the spring here would necessarily rise to the surface, because in the well at Elbeuf, which is nearly 9 yards above the level of the sea, the water rises from 27 to 29 yards above the surface of the earth, and, consequently, from 36 to 38 yards above the ocean level. Now, as the orifice of the bore at Grenelle is only 34 yards above the same level, it follows, that if the identical spring be met with, the water must rise above the earth's surface at Grenelle.

But one other condition is requisite to ensure the rising of the water in an Artesian well, namely, that the feeding level of infiltration should be higher than the orifice in the bore above which the water is to ascend. This, however, turned out to be the case of the borings of the wells at Rouen, Elbeuf, and Tours, where abundant supplies of water had been found below the chalk, between similar strata of clay and gravel.

The necessary works were commenced with boring rods about 9 yards long, attached to each other, and which could be raised or lowered by mechanical power, while an ingenious method was adopted for giving them a rotary motion. The diameter of the bore was about 6 inches. The instrument affixed to the end of the lowest boring-rod was changed according to the different strata which were successively attacked; the form suited for passing through the softer materials near the surface being unsuitable for boring through the chalk and flint, as a hollow tube was used for the former, while a chisel-shaped tool was employed to penetrate the latter. The size of the rods was lessened as the depth increased; and, since the subterranean water was not reached as soon as was expected, it became requisite to enlarge five several times the diameter of the bore, in order to permit the work to be successfully prosecuted. Accidents occurred which tried the patience of the projectors. In May, 1837, when the boring had extended down to a depth of 418 yards, the hollow tube, with nearly 90 yards of the long rods attached to it, broke, and fell to the bottom of the hole, whence it became necessary to extract the broken parts before any further progress could be made. The difficulty of accomplishing this task may be conceived; for the different fragments were not all extracted until after the constant labour of 15 months. Again, in April, 1840, in passing through the chalk, the chisel attached to the boring-rod got detached, and, before it could be recovered, several months were spent in digging round about it. A similar occurrence created an obstacle which impeded the work for 3 months; but, instead of withdrawing the detached part, it was forcibly driven down among the stratum of gravel. At length, in February, 1841, after 8 years' labour, the rods suddenly descended several yards, having pierced into the vault of the subterranean waters so long sought after by the indefatigable engineer. A few hours afterwards he was rewarded for all his anxious toils; for lo! the water rose to the surface, and discharged itself at the rate of 600,000 gallons per hour!

The depth reached down was 602 yards, or about three times the height of St. Paul's. The pipe by which the water reaches the surface has been recently carried to a height nearly level with the source of supply. The portion of the pipe above the ground is surrounded with a monumental pagoda of ornamental carpentry, and it discharges a circular cascade of clear water continually into a circular iron reservoir, to be thence conveyed by a lateral pipe to the ground. The water is well adapted for all domestic uses, and it will be unfailing, being supplied from the infiltration of a surface of country nearly 200 miles in diameter. The Artesian wells of Elbeuf, Rouen, and Tours, which were formed many years ago, overflow in never varying streams; and the ancient Artesian well at Lillers, in the Pas de Calais, has for about seven centuries furnished a constant and equable supply.

The opportunity of ascertaining the temperature of the earth at different depths was not neglected during the progress of the works at Grenelle. Thermometers placed at a depth of 30 yards in the wells of the Paris Observatory invariably stand at 53° Fahrenheit. In the well at Grenelle the thermometer indicated 74° F. at a depth of 442 yards, and at 550 yards it stood at 79°. At the depth finally arrived at of 602 yards, the temperature of the water which rose to the surface was 81°, corroborating previous calculations on the subject. For a descent of 572 yards there is an increase of temperature equal to 28° F., which is 20·4 yards, or 61·2 feet for each degree of that scale. Now that the skilful labour of so many years is terminated, the Parisians regret that the subterranean sheet of water had not lain 1000 yards beneath the surface, that they might have had an overflowing stream of water at 104°, to furnish a cheap supply to their numerous hot-bath establishments.—*Dr. Ure's Supplement to his Dictionary of Arts, Manufactures, and Mines.*

ON THE PURIFICATION OF COAL GAS, AND THE APPLICATIONS OF THE PRODUCTS THEREBY OBTAINED TO AGRICULTURAL AND OTHER PURPOSES. BY ARCHIBALD ANGUS CROLL, ESQ., C.E.

[From Minutes of Transactions of the Institution of Civil Engineers, June 11, 1844.]

The production of coal gas is now become of such importance, from the amount of capital employed in it, and the high degree of public utility resulting from the introduction of gas light, that the author conceives it to be his duty to lay before the Institution, an account of his improvements in the process of purifying and preparing gas for combustion.

In London alone, the annual rental paid to the different Gas Companies, for the supply of coal gas, amounts to about 600,000*l*., and 250,000 tons of coal are annually consumed in its manufacture. As nearly every town of two or three thousand inhabitants, is now lighted with gas, vast as is the consumption of London, it forms but a small portion of the quantity of coal gas produced in the United Kingdom. The use of gas seems, however, to be capable of much greater extension than it has yet attained; for though almost universally adopted in the lighting of streets, workshops, warehouses, and places of business, it has been only partially introduced into domestic use. The causes of this limitation in the use of gas are sufficiently obvious; they consist mainly in the unpleasant odours and unhealthy effluvia, supposed to be exhaled in its combustion; nor have the objections made on that account been without foundation; for it is well known to chemists that, notwithstanding all that modern science and invention have hitherto done to purify gas, a considerable portion of ammonia, and its compounds, the origin of the offensive and injurious vapour complained of, still exist in combination with the gas, and compounds of a deleterious character are given off during combustion.

The author's attention has long been directed towards the manufacture and purifying of gas, and in the progress of numerous experiments, which were continued through several years, he has been fortunate in the discovery of a very simple process, of entirely freeing coal gas from ammonia, and its various combinations.

The gas used for illumination, is carburetted hydrogen, and the object of all gas manufacturers is to obtain that gas in the greatest possible state of purity, and at the least comparative expense. The method of making coal gas is this: coal being placed in retorts, and subjected to a high degree of heat, the carburetted hydrogen gas is generated, from whence it passes, by well-known contrivances, into the condensing apparatus; but the carburetted hydrogen thus generated, contains several gaseous impurities, the most prominent of which are,—1°, sulphuretted hydrogen; 2°, hydro-sulphuret of ammonia; 3°, cyanuret of ammonia; 4°, carbonic acid, &c.; all these impurities have, to a great extent, been got rid of in all well-conducted gas works. The sulphuretted hydrogen and the carbonic acid are most effectively removed by means of dry lime; but to its use (until the application of this process) insuperable objections existed, and it has therefore been usually abstracted from carburetted hydrogen, by wet lime purifiers. A large portion of the hydro-sulphuret of ammonia, the cyanuret of ammonia, and the carbonic acid, have been thus expelled, with much trouble and inconvenience. Still a very great quantity of ammonia remains, unaffected by all the processes used for purification, and passes, as before observed, into consumption with the gas itself.

The carburetted hydrogen, thus generated, passes, with all the impurities mentioned, into the condensers, where the hydro-sulphuret of ammonia is to some extent removed, by a reduction of the temperature of the gas, and in this way the ordinary ammoniacal liquor of the gas-works is obtained. That liquor is generally sold to manufacturing chemists, and from it, after saturation with either sulphuric or muriatic acid, the ordinary ammoniacal salts are produced. From each gallon of this liquor about 14 ounces of sulphate of ammonia are produced.

The author's new process of purification is generally employed immediately after the gas passes out of the condensers; or it may be applied when the gas has undergone the usual wet or dry lime purification.

The gas is conducted into a circular vessel, constructed like those in use for the purpose of washing gas, and lined with lead, that metal not being acted upon by sulphuric acid; it is divided at the bottom into a number of sections, 8 inches or 10 inches in height, which support a lead plate, covering the whole surface of the vessel, except about 5 inches round the edge. The vessel is charged, up to the height of the plate, with water, to which oil of vitriol, at the rate of about 2½ lbs., or thereabouts, of acid, to 100 gallons of water, has been added; the gas is then passed under the leaden plate, where the divisions by which it is supported completely separate the gas, and bring each portion of it into contact with the acid solution. The ammonia contained in the gas combines chemically with the sulphuric acid, and

forms sulphate of ammonia. But the acid being thus constantly in process of neutralization, the solution would soon lose its power of separating the ammonia from the gas, but for a small reservoir of sulphuric acid, which being carried into the vessel by means of a pipe furnished with a stop cock, insures a regular supply of acid. The gas thus freed from ammonia is carried to the dry lime purifiers, which with this process can always be used. In large works, two vessels of this kind are preferable for passing the gas twice over the weak solution of sulphuric acid, which secures a more absolute certainty of the extraction of all the ammonia, should there have been any accidental or temporary deficiency of acid in one of the vessels.

Two vessels of 10 feet diameter and 3 feet deep will purify 500,000 feet of gas every 24 hours, and making that quantity will require to be charged with the acid solution about every two days.

In order to prevent too great a strength of free acid in the vessel, which would precipitate the carbon of the gas, and diminish its illuminating power, the liquor may be tested with the common ammoniacal liquor of the gas-works.

When the solution in the vessel has become of the specific gravity of 1170, or thereabouts, as ascertained by the hydrometer, the supply of acid is to be shut off, and the gas is passed through the vessel, until that solution will restore the colour to reddened litmus paper.

The liquor thus obtained is evaporated, and produces sulphate of ammonia of remarkable purity, and of such strength, that one gallon produces 80 ounces of sulphate of ammonia, instead of the 14 ounces only which are produced from the ordinary ammoniacal liquor of the gas-works. And this last-mentioned liquor must first undergo the process of saturation with sulphuric acid before evaporation.

The same degree of purification of gas from ammonia, may be obtained, by means of chloride and sulphate of manganese, or chloride and sulphate of zink, which salts are afterwards reproduced, to be used again and again in the same process.

In the ordinary mode of purification the gas was conveyed directly from the condensers to the wet lime purifiers; a considerable pressure on the retorts was requisite to force the gas through the fluid lime, and thus a loss of gas ensued, with a larger incrustation of carbon in the retorts, and extra labour was necessary for agitating the liquid lime, and for conveying the refuse liquor to be evaporated. This being effected in pans, placed under the retort furnaces, the sulphur given off tended to destroy very rapidly the iron retorts, which were exposed to the action of the flame. The wet lime purified the gas from the sulphuretted hydrogen, a great portion of the hydro-sulphuret of ammonia, the sulpho-cyanuret of ammonia, and the carbonic acid; but it still allowed a considerable quantity of ammonia and its compounds to pass into consumption with the gas.

The dry lime purifiers, used without this process, presented some advantages to the gas companies over the plan of purifying with wet lime; but it was only in open places in the country that the dry lime could be used, without the works becoming a public nuisance. The objection to dry lime purifiers arose from this cause: the hydro-sulphuret of ammonia, which is generated with carburetted hydrogen gas, is highly volatile, and that portion which is extracted by the lime, having no chemical affinity for lime, but being merely held in mechanical combination, had a strong tendency to fly off.

The hydro-sulphuret of lime is formed in the dry lime purifier, from the sulphuretted hydrogen of the gas; on the opening of the vessel, it rapidly combines with the oxygen of the atmosphere, and becomes converted into sulphate of lime. During that conversion, heat is rapidly evolved, which renders the hydro-sulphuret of ammonia, extracted from the gas by the lime purification, more volatile than ever, and the most offensive stench is the consequence. Besides, so noxious is this gas, that a comparatively small portion of it, in a given volume of atmospheric air, would render it destructive to animal life.

These obstacles would warrant the almost universal abandonment of dry lime purifiers; now, however, in connexion with this process of purifying gas from ammonia, the dry lime purifier will, it is anticipated, become the only system used for the abstraction of the sulphuretted hydrogen. The gas purified from all ammonia, by passing over the solution of sulphuric acid, has only to be freed by the dry lime purifier from the sulphuretted hydrogen, the sulpho-cyanuret, and the carbonic acid, which form, in chemical combination with the lime, the hydro-sulphuret of lime, cyanuret of lime, and carbonate of lime, neither of which are volatile, but are highly valuable for agricultural purposes.

In those instances in which the localities have permitted gas companies to continue the use of dry lime purifiers, the value of the products as manure has been so well understood, that the refuse lime has been bought up as fast as it was produced; and an impression having prevailed, that this

refuse lime owed its value to the presence of ammonia, some of the contractors of such gas-works have expressed an apprehension that the adoption of this process, by previously abstracting the ammonia, would destroy the valuable properties of this lime.

It is evident that this is entirely a misapprehension. The chemical causes before detailed will have shown that the hydrosulphuret of ammonia, which had been extracted from the gas, in the dry lime purifiers, having been volatilized and lost, long before the refuse lime (then become sulphate of lime) could have been taken from the works, the value of the lime really consisted in the fertilizing power of the sulphate of lime and of the cyanuret of lime. This power will still exist in the same products, concurrently with the use of this process, while the noxious exhalations, which formerly occurred on the opening of dry lime purifiers, will be absent.

In manual labour alone, the Chartered Gas Company have effected a saving, at their Brick-lane station, of between 400*l*. and 500*l*. a-year, by the use of dry lime instead of wet lime purifiers.

Against these many advantages, however, it is proper to mention, that there will be a slightly increased quantity of lime required, in purifying with dry instead of wet lime; for a bushel of lime in the wet process purified from 18,000 to 20,000 feet of gas, while in the dry lime process the same quantity will only purify 14,000 feet; but this trifling drawback on the dry lime process does not render the comparative merits of the two processes in any degree doubtful.

Various plans have been tried, at different times, to separate the ammonia from the coal gas by means of acids, but either from their expense, or their complication and practical difficulty, or from their effect in diminishing the illuminating power of the gas, all of them have been successively given up as useless. But by this process, all those difficulties are avoided, whilst numerous positive benefits have resulted. The process has been adopted by the Chartered Gas Company, the Imperial, and Phœnix Gas Companies in London, and by several gas companies in the country; and several of the other metropolitan companies have the subject of its adoption under their consideration.

In addition to the advantages arising from the use of the dry lime in place of the wet lime purifiers, which this process renders everywhere possible, the saving which will accrue upon the meters and fittings of the Chartered Gas Company, by the abstraction of the ammonia from the gas, will amount to a considerable sum annually.

At the Brick-lane station the number of meters requiring repair has already been reduced by one-half, and those annually condemned have been two-thirds less, since this process has been adopted, although an increase of meters has taken place. The public lamp fittings requiring repair, since its adoption, have also been two-thirds less in number than previously. A large saving in wear and tear has thus been effected by the plan. In addition to the above, the illuminating power of the gas has been increased upwards of 5 per cent. by its freedom from ammonia, and it may now be consumed in the drawing-room or bed-chamber, with as little inconvenience or effluvium as a wax candle.

In addition to the advantages already enumerated, this process comprises another, fully equal, if not superior to all the rest. This consists in fixing and neutralizing the ammonia in combination with sulphuric acid, and making it available in the form of the valuable product of sulphate of ammonia.

Already many tons are produced weekly from the works which have adopted this process, and the purity of the product has been sufficiently attested. It is unnecessary to enumerate the various manufactures and arts in which sulphate of ammonia is useful or necessary; but the author draws attention to its value for agricultural purposes, a subject upon which many men of science, education, and capital, have for several years past bestowed so much attention.

Next to the mechanical operations upon land, such as complete drainage, and the more perfect disintegration of the soil, which are conditions necessary for improved culture and a high degree of fertility, there is nothing so important to successful farming, as the selection and right application of manures. This, chemistry alone can teach; and accordingly we find that chemistry is now universally studied with reference to agriculture, by all agricultural improvers, and the knowledge which a Liebig, a Johnston, or a Henslow, have attained and tested by experiment is being diffused throughout our rural districts.

The object of the skilful husbandman is not merely to produce quantity, but he must have quality also; he must be certain that he is growing the peculiar productions he desires, in their most complete state, and at the least comparative expense. It is known, that plants cannot attain maturity, in the richest vegetable mould, without the presence of nitrogen. Liebig says—"Every part of the organism of a plant contains nitrogen, the roots and seeds being particularly rich in that element; and as there cannot be a doubt but a soil must gradually lose those

of its elements which are removed by the plants raised upon it, but which, if the land is to be kept in a permanent state of fertility, must be supplied in the form of manures possessing the elements which have been so abstracted."

This fully and scientifically explains that which has long been matter of daily observation, namely, that the so frequent repetition of grain crops, speedily exhausts most land. The nitrogen taken away in the form of corn has become deficient, and must be supplied by the extraneous aid of manure, or less perfectly, through the slow operation of the atmosphere.

The first inquiry for the farmer, therefore, is that asked by Liebig, " How, and in what form, does nature furnish nitrogen to vegetable albumen, and gluten to fruits and seeds?" The question is susceptible of a very simple solution.

" Plants,* as we know, grow perfectly well in pure charcoal, if supplied at the same time with rain-water. Rain-water can contain nitrogen only in two forms, either as dissolved atmospheric air, or as ammonia, which consists of this element and hydrogen. Now the nitrogen of the air cannot be made to enter into combination with any element except oxygen, even by the employment of the most powerful chemical means. We have not the slightest reason for believing, that the nitrogen of the atmosphere takes part in the processes of assimilation of plants and animals; on the contrary, we know that many plants emit the nitrogen which is absorbed by their roots, either in the gaseous form, or in solution in water. But there are, on the other hand, numerous facts, showing that the formation in plants of substances containing nitrogen, such as gluten, takes place in proportion to the quantity of this element which is conveyed to their roots in the state of ammonia, derived from the putrefaction of the animal matter."

"Ammonia too, is capable of undergoing such a multitude of transformations, when in contact with other bodies, that in this respect it is not inferior to water, which possesses the same property in an eminent degree. It possesses properties which we do not find in any other compound of nitrogen: when pure, it is extremely soluble in water; it forms soluble compounds with all the acids; and when in contact with certain other substances, it completely resigns its character as an alkali, and is capable of assuming the most various and opposite forms. Formate of ammonia changes, under the influence of a high temperature, into hydrocyanic acid and water, without the separation of any of its elements. Ammonia forms urea with cyanic acid."

The same eminent chemist subsequently shows, most conclusively, that the ammonia, from which alone vegetables derive their nitrogen, is supplied by means of rain-water from the atmosphere, or by the use of manures containing that gaseous fertilizer. That ammonia, which, from its volatile character, is constantly escaping into the atmosphere, from its great solubility in water, quickly descends with the rain to reproduce abundant vegetation; and that all manures owe their degrees of fertilizing power, in a great measure, to the amount of ammonia they contain.

But when we remember to what an extent the loss of nitrogen takes place; that the liquid and solid excrements of each individual, amounting, on an average, to 1¼lb. daily, and containing 3 per cent. of nitrogen, or about 16lbs. per annum, are almost entirely lost; and that each man carries to the grave with him nearly 3lbs. of nitrogen, it will be obvious that the soil from whence man's food is drawn, cannot be supplied with sufficient nitrogen from the atmosphere alone. Hence in practice we see, that each farm is always in the course of improvement or deterioration; there is no neutral condition for the farmer, he must go on or fall back. The good farmer purchases artificial manures, maintains large flocks and herds, often fed on corn, oil-cake, and other food rich in nitrogen; constructs tanks, for the reception and preservation of liquid manure, which contains far more ammonia than the solid excrements of animals; and under such treatment he finds his fields, year by year, increasing in fertility, and himself growing in wealth; while the bad farmer sows, reaps, and sells, with grasping eagerness, all the grain he can obtain, without cattle, without sheep, or with such as he may have in a half-fed state; he tries no foreign manure, he uses no artificial food, and after a few years of struggle without what he designates "bad times," he finds that his land will scarcely return seed for seed, and he is a ruined man.

The agricultural chemist would describe this contrast, which involves much of human happiness and misery, by the simple statement that the one man is constantly adding ammonia to his land, and the other is as constantly abstracting it.

Such and similar considerations, which will naturally occur to the reflecting mind, show the important influence of a process in the advancement of husbandry, which can furnish a vast supply of ammonia in a form

* Vide "Chemistry, in its application to Agriculture and Physiology." By Justus Liebig, edited by Lyon Playfair. 8vo, London, 1842. Taylor and Walton.

and at a cost which brings it within the reach of the humblest agriculturist, from a source previously unfruitful. It forms literally a new mine of wealth, drawn from the exhaustless coal formation of the earth's former vegetable productions.

A chemical analysis of the sulphate of ammonia, produced by the evaporation of the saturate-sulphate liquor, before described, as drawn off from the purifying vessels, shows it to be of great purity, as it affords in 100 parts, nearly 30 parts of ammonia, after deducting water and sulphuric acid, equivalent to about 24 parts of nitrogen. This shows a fertilizing power two or threefold greater than any other manure.

Actual experiments have corroborated the conclusions of the analytical chemist, and some of the most accurate of these are recorded by Mr. W. M. F. Chatterley, at the Manor Farm, Havering-atte-Bower, in Essex, occupied by Collinson Hall, Esq. These were made in 1842, a season which, like the present, (1844,) was, from its dryness, by no means favourable to top dressings.

A field of wheat, which, at the latter end of April, had presented a very thin plant, was dressed on the 12th of May, with sulphate of ammonia, nitrate of soda, and nitrate of potash. In August, four equal portions of the field were measured.

No. 1, which had received no manure, produced per acre 23¾ bushels of wheat, weighing 1413 lbs. = 59½ lbs. per bushel; and 63½ trusses of straw, weighing 2287 lbs.

No. 2 had been dressed with 1¼cwt. of sulphate of ammonia, at a cost of 1*l*. 1*s*. 9*d*. per acre. The produce of the acre was 32¾ bushels of wheat, weighing 1999 lbs. = 61½ lbs. per bushel, and 71½ trusses of straw, weighing 2571 lbs.; showing an increase of 9 bushels of wheat, and in money profit of 1*l*. 16*s*. 9*d*. per acre.

No. 3 had been dressed with 1cwt. of nitrate of soda, costing 1*l*. 4*s*. 6*d*.; it produced 31½ bushels of wheat per acre.

No. 4 had been dressed with 1cwt. of nitrate of potash, costing 1*l*. 7*s*. 6*d*.; the latter also produced 31½ bushels to the acre.

The experiments show a considerable advantage from using the sulphate of ammonia, and mark still more distinctly, the benefits derived from supplying the wheat plant with the nitrogen it requires, in the form of ammonia. It will be remarked, that the weight of the wheat, the grand test of its quality, was increased by the use of sulphate of ammonia, and this alone would add at least 1*d*. or 2*d*. per bushel to the selling price. Other experiments might be detailed, but they have all shown very similar results. 200 lbs. of sulphate of ammonia applied in 1843 to poor grass land, by Mr. Bower, of West Dean House, produced an increase of 10 cwt. of hay per acre.

The result of all the experiments, however, seems to show, that 1 cwt. of sulphate of ammonia per acre, whether applied to grain or to grass crops, gives a maximum of profit for the outlay.

There is still another form in which ammonia may be used for supplying nitrogen to plants, which has been attended with so much success, that it must be mentioned. It is by steeping the seeds in a solution of sulphate of ammonia. An account of an actual experiment is given in the *Mark Lane Express*, of the 27th of May, 1843. The results there stated, accord very closely with experiments made under the author's own observation. The writer says—"I steep the seeds in sulphate, nitrate, and muriate of ammonia, in nitrate of soda and potash, and in combinations of these, and in all cases the results were highly favourable. For example, seeds of wheat steeped in sulphate of ammonia on the 5th of July, had by the 10th of August, tillered into nine, ten, and eleven stems, of nearly equal vigour; while seeds of the same sample, unprepared, but sown at the same time in the same soil, had not tillered into more than two, three, and four stems."*

These facts are decisive as to the value of the process, with reference to agriculture.

It must be recollected also, that by the application of this process, one ton of sulphate of ammonia may be produced from every million cubic feet of coal gas generated, and that the quantity so obtained will dress 20 acres of wheat; producing thereby, a clear profit of 1*l*. 15*s*. per acre, or 35*l*.

The total yearly quantity of coal gas made in London, has been estimated at 2,400,000,000 of cubic feet; whence some idea may be formed of the amount of sulphate of ammonia, which this process may render available for the purposes of agriculture.

It should be observed also, that this quantity is over and above that ammonia which was, and still is, obtained from the common ammoniacal liquors of the gas-works, and that the process which enables such agricultural benefits to be secured, effects at the same time, a considerable saving in the manufacture of gas by the companies which have adopted it, while the use of coal-gas for the purpose of illumination, from its being

* The proportions of the solution used for steeping wheat are 1 lb. of sulphate of ammonia to 1 gallon of water; and the seed should remain in the solution for 24 hours. If the sulphate of ammonia is used for the land when the crop is growing, the proportion is from 1 cwt. to 1½ cwt. per acre, according to the state of the crop.

rendered more agreeable and healthy, will be greatly extended in all private families.

Mr. Lowe confirmed the statements in the paper, relative to the advantages of the new system. Formerly, when the dry lime purifiers were used at the Brick-lane Gas Station, the health of the men suffered, and the complaints by the neighbourhood, of the nuisance when the lime was changed, were so constant, that the system was abandoned; at present, although ten times the quantity of gas was purified, there was not any nuisance, either in the works, or in the neighbourhood.*

It had been stated, that the system had been used in other places, and that the credit of the invention was not due to Mr. Croll. Although it was not the province of the Institution to enter into such an inquiry, he might perhaps be allowed to state, that a similar plan had been tried at Bristol, at the suggestion of Mr. Wm. Herapath; the idea had originated in the same chemical facts which had induced Mr. Croll's attention to the subject, but the *modus operandi* was essentially different. In Mr. Herapath's plan there was not any continuous supply of acid; no valuable product was obtained; it was troublesome and expensive; hence it was not successful, and the plan was abandoned. Mr. Croll had entered upon the subject with, perhaps, more practical skill, which, joined to his chemical knowledge, had enabled him to attain the success which attended the present system.

The economy of the process, the diminution of the destructive effects of the purified gas upon the apparatus and the fittings, its increased illuminating power, and its greater fitness for combustion in dwelling-houses, with other advantages, had been fully and fairly stated in the paper.

The chemical products obtained from the process deserved very careful attention, and their adoption for agricultural purposes was important. The effect of sulphate of ammonia, in assisting vegetation, was remarkable, and it was already extensively used in agriculture. It also revivified cut flowers, when they were apparently withered and dying. Flowers, whose stems were cut diagonally, so that their capillary tubes were not bruised or torn, on being put into a solution of 8 grains of sulphate of ammonia to 1 pint of water, would be speedily restored to vigour, if somewhat faded, and they might be kept fresh by this means for a long period. For watering geraniums and other plants growing in pots, $\frac{1}{4}$ lb. of sulphate of ammonia should be dissolved in 1 gallon of water, and a wine-glass of this solution added to every quart of water: the strength and beauty of the plants were found to be much improved.

Professor Graham bore testimony to the efficacy of Mr. Croll's process for removing ammonia from coal-gas, and to the valuable nature of the products obtained. Looking at the purifying of coal-gas as necessarily founded upon sound chemical principles, he thought that more attention might still be advantageously paid to several parts of the process.

In the first step of the purification, namely, the proper cooling of the gas as it escaped from the retorts, he suggested a gradual refrigeration of the gas, or the retaining it for a short time, at an intermediate temperature, such as 212° Fahrenheit, before it was cooled down to the temperature of the air in the usual refrigerators. The tarry matters in the gas, being the least volatile, would thus condense first, and by themselves, at a temperature which, being inadequate to condense the naphtha, would prevent their carrying down with them so much of the valuable naphtha vapour as at present. These tarry matters, having an affinity for naphtha, tended powerfully to denaphthalize the gas when in contact with it at a low temperature, and to deprive it of that valuable adjunct for combustion.

The mode of purifying coal-gas from sulphuretted hydrogen by dry lime was gradually superseding the wet lime process, particularly when the former was used in combination with the acid process. The dry lime, however, was so far disadvantageous, as that it could never be entirely saturated with sulphuretted hydrogen.

Professor Graham had found, that, by mixing an equivalent proportion of sulphate of soda with the lime, more than twice the quantity of sulphuretted hydrogen was taken up. The lime was entirely converted into sulphate of lime, or gypsum, and the whole soda became bi-hydro-sulphuret of soda, which might be easily washed out of the former. The latter salt might be again converted into sulphate of soda by roasting it, and thus might be used to mix with the lime

* In a report to the Directors of the Chartered Gas Company, dated November 19th, 1841, Professor Brande says,—"I think it probable that much of that anomalous fetor and penetrating effluvium which infects the gas mains and the soil in which they lie, and which is generally, but, I think, erroneously, merely ascribed to tar and naphtha, is in great part attributable to ammonia and its compounds, and that this nuisance will be found greatly diminished, if not altogether prevented, by passing the gas through dilute acid liquors before it enters the main. Ammonia, and some of its compounds, exhibit penetrating and peculiar reactions upon certain metals, and are also probably concerned in some of those curious phenomena of exosmose, and endosmose, which now constitute an important element of the philosophy of gaseous chemistry."

in the purifiers over and over again. Sulphate of lime, which was the only residue, was valuable for agricultural purposes.

In the distribution of coal-gas every means for counteracting the porosity of the pipes should be adopted. In experiments upon cast-iron gas-pipes, he had found as much as 25 per cent. of atmospheric air mingled with the coal-gas, which had been in the mains for 12 hours. This arose entirely from the porosity of the metal, air entering by the diffusive power of gases, although the coal-gas in the main was under a small pressure. This should be guarded against, not only on account of the positive loss of gas which it indicated, but because, as was well known, a moderate proportion of atmospheric air mixed with the gas greatly diminished its illuminating power.

Mr. Bethell said that his attention had been directed to the use of chemical agents for agricultural purposes by a notice in the journals of the professions of a German chemist to obviate the necessity for manuring corn land. Mr. Bethell, in consequence, tried various solutions, in which seeds were steeped for 40 hours; they were then sown in different patches of unmanured land, and he found that, although with some of the seeds which had been in other solutions vegetation was more rapid, yet that the produce of the seed which had been steeped in a solution of 1 lb. of sulphate of ammonia to 1 gallon of water was more vigorous and prolific; and that during a dry season, when all the other wheat became yellow, the plants from the steeped seed remained green.

Mr. Simpson stated, that in connection with the subject of gas-making, the porosity of the iron pipes, through which it was circulated in the streets, should be noticed. He believed that formerly considerable quantities of pipes had been laid without their being previously proved; and even now, experiments he had made convinced him, that few pipes were not in some degree porous. When they were proved with water, under a heavy pressure; and a mirror was placed near the surface of the metal, a damp film showed the permeability, and after the pressure had been continued for some time the exudation of moisture was very visible. Oxydation would, to a certain extent, close the pores of the metal, and prevent this effect; and he would suggest, that all pipes should be proved with a solution of sal-ammoniac, which being forced into the body of the metal, would effectually oxydize it, and to a great extent cure the evil. He felt convinced, that 25 per cent. of the gas was lost, from the leakage of the pipes and the joints; and in opening the streets, the difference between the gas and the water pipes was immediately perceived, by the soil around the former being saturated with gas.

Mr. Simpson quoted an instance where, in a length of 1,000 yards of iron pipes, two inches in diameter, there had been a loss of 357 cubic feet of gas in twenty-four hours. By perseverance in repairing the escapes, the porous spots and other defects in the metal of the pipes, the leakage had been reduced in three years to about 13 cubic feet in 24 hours.

Mr. Lowe said, that although, in the early stages of gas-lighting, the pipes laid in the streets might not have been proved, such was not now the case; at present all were severely tested; and great attention was paid to the formation of the joints, which were made by ramming in layers of gasket, previously soaked in hot pitch and tallow, then running in the lead; and after that was well driven up with a caulking iron, the joint was smeared over with pitch.

The gas companies were fully aware of the loss they had sustained from defective pipes and bad jointing, and every attention was now given to the subject. Some time since, Mr. Lowe had been called upon to examine a provincial gas-work, where, although the consumers paid by meter, and an allowance of 6 cubic feet of gas per hour was made for each public light, 75 per cent. of the gas which was manufactured was not accounted for. On examination, it was found, that from the ignorance of the superintendant, a pressure of 2 inches of water was kept constantly by day upon the pipes. The process of exosmose was thus carried on to an enormous extent. As soon as the pressure was diminished, the loss was reduced in proportion; and when, by his advice, the gas was allowed for a time to pass into the pipes in a less pure state than usual, the leaks were soon discovered and repaired. It was certain that the process of endosmose and exosmose was constant with gas-pipes, as the cast iron was of a porous and cellular texture; and he believed that a great portion of the loss arose from the permeability of the metal. He noticed, on opening the streets, that the soil in contact with the whole length of the gas-pipes was saturated with gaseous products, and not merely those spots near the joints.

Mr. Murray remarked, that Mr. Hague had found great difficulty in remedying the permeability of cast iron, when he attempted to work his engine with condensed air: it was only by coating the pipes with a mixture of tallow and pitch that he succeeded in rendering them partially impermeable.

Mr. Farey observed, that the porosity or permeability of cast iron was a well ascertained fact. This first came to his know-

ledge many years ago, in the case of a hydrostatic or Bramah's press, wherein the water, when very forcibly compressed, made its way slowly through the thick cast-iron cylinder by a sort of perspiration at the external surface, so that the press relaxed its pressure, and the plunger descended considerably during the night, after a large package of elastic goods had been left in it under strong compressure in the evening. The external surface of the cast-iron cylinder was found, the next morning, covered with very minute drops of water, particularly towards the lower end, where the drops were larger. Before this exudation of the fluid was observed, the workmen said the water had leaked out at the leathering around the plunger, or at the joints; but as a considerable quantity of water must have leaked, in order to have so much relaxed the press; and as little or no water showed itself at the leathering or joints, further search was made and the real cause was discovered; but as only very little water had dripped down on the ground, it had probably evaporated in the air, nearly as fast as it exuded, in a state of minute division.

It was remedied by withdrawing the plunger, warming the cylinder over a fire of shavings, and lining the interior surface, when warm, with a mixture of melted bees'-wax and resin, forming a thick varnish. The press stood well afterwards, and the case showed, that leather, not thicker than the sole of a strong shoe, was less permeable to cold water, under great pressure, than cast-iron of some inches in thickness.

On mentioning the circumstance to the late Mr. Maudslay, he said, that whilst he was engaged with Mr. Bramah, and made the small hydrostatic presses for copying letters, he observed that some of the cylinders permitted the water to exude through the gun-metal, which was a composition of copper and tin, from which they were cast. By watching the proceedings of the workman who poured the melted gun-metal into the moulds, which were placed in an inclined position for the convenience of receiving the melted metal, Mr. Maudslay observed, that immediately after the pouring, it was a habit with the workman to set the moulds upright with a sudden motion. This, Mr. Maudslay thought, might disturb the metal at the moment of its solidification, and after prohibiting that practice, and leaving the moulds quite at rest, until the metal must have become completely set, the cylinders generally proved sound.

As to cast-iron, it was not always a close-grained metal; the carbon which it contained, and which constituted its difference of substance from pure malleable iron, pervaded the mass, divided into minute particles, which kept the molecules of iron apart, and impaired their cohesion. Such cast-iron was very fusible, ran well into the moulds, and was soft for working with tools. It was called No. 1 rich iron, of best quality, for foundry metal; it was also called 'kishy' iron, from an appearance of particles of carburet of iron, or black lead, on its surface, after the iron had been left to cool, in the open air. That was accounted for, by supposing that the iron absorbed more carbon from the fuel, in the blast furnace, whilst it was in the fluid state, than the same iron could retain when it afterwards cooled and solidified; and that the molecules of iron in approaching each other, during the solidification, expelled a portion of the excess of carbon from between them,* with a curious vermicular motion, which could be observed, on the surface of the melted metal, whilst it was cooling; and it was the carbon which was so expelled that showed itself in these particles of carburet, after the iron was cold.

That vermicular motion must be inimical to the future solidity of the metal, and such kishy metal, although soft for working with tools, was in fact deficient in cohesion; it did not make strong castings, was unfit for wearing to resist friction, and was porous to gas, air, and water under pressure.

It was only by causing cast-iron to absorb carbon slowly from the fuel, in the blast furnace, that it could be wholly freed from the oxygen, with which the iron was combined, when it was in the state of ore, and the more carbon that was so absorbed, the more completely the oxygen was got rid of.

At least that was the case in the ordinary process of smelting iron with cold blast, by a slow process of such absorption; but the hot blast process appeared capable of inducing a very rapid absorption of carbon, by a mass of cast-iron in the blast furnace, which rapid absorption was not attended with such a complete deoxydation of the iron, as would take place with a less absorption of carbon, by a slower process of such absorption in the cold-blast process. Probably by the hot-blast process, when urged too rapidly, some portions of the cast-iron contained in the furnace, were very completely deoxydated, and had absorbed such a great excess of carbon into the interstices between them, as would keep the molecules of metal apart, and impair their cohesion, whilst other portions of the same mass of iron might remain imperfectly deoxydized, and, for want of time, had not absorbed their proper share of the carbon, which was contained in the mass generally; such imper-

fectly deoxydised particles would be deficient in cohesion for want of complete metallization.

These suppositions might serve to explain, why hot-blast iron having the character of rich kishy iron, was so deficient in cohesion, but by allowing more time for the smelting operation, hot-blast iron might, he conceived, be made of excellent quality.

Cast iron which was rich in carbon, might be made to part with so much of its excess of carbon in re-melting as to acquire a full cohesion; and such excess might be neutralized, by melting the rich iron along with a suitable proportion of old castings, which, by previous meltings, had been deprived of their excess of carbon. Messrs. Boulton and Watt, at the commencement of their career, paid great attention to that subject for the casting of cylinders, and other parts of their steam-engines, and by availing themselves of all that had been learned in the casting of iron cannon, and by the judicious mixture of different sorts of cast-iron in the operations of the foundry, they obtained castings which have never been excelled, and rarely equalled, for solidity and strength.

Cast-iron of that first-rate quality had the molecules of metal in close contact, hence their cohesion was great, and the metal was impervious to water, gas, or air.

Respecting the leakage of gas from cast-iron pipes, a very large proportion proceeded from the joints of the lengths of pipes. At Manchester it had been the custom for several years past to form the joints of cast-iron pipes by boring and turning the ends to fit truly the one into another; and, very recently, Mr. Hick, of the firm of Forrester and Co., at Liverpool, had shown him a machine which performed the operation of both boring and turning the two ends of a pipe very rapidly. It was a slide lathe bed, having two head stocks with strong mandrils fixed upon it, one near each end; they were placed at such a distance asunder on the bed as to receive the length of the pipe between them; each mandril had a chuck upon the end of it, with notches into which steel cutters were wedged like a boring head. One such chuck was adapted for boring out the interior of the socket-end of the pipe to a suitable cone; the other chuck had its cutters set for turning the exterior, at the other end of the same pipe, to a corresponding cone. The pipe was fastened down on a sliding carriage, so as to present first one end of it to one chuck, and then the other end of it to the other chuck, by which means the whole operation was very expeditiously and perfectly performed. This mode of preparing pipes was becoming common in Liverpool and Manchester, and was, he thought, deserving of more general adoption.

Mr. Cooper reminded Mr. Lowe of an experiment, at which he was present a few years since, where the process of endosmose and exosmose was shown very strikingly. A bag formed of two sheets of paper, pasted together all around the edges, was inflated with coal-gas by introducing a quill at one corner; in 10 seconds it was discovered that the gas had entirely escaped, and its place was occupied by common atmospheric air, although no visible defect existed in the bag.

He thought that the soft and porous quality of the iron of which the pipes were made, for the convenience of drilling and tapping them for the service branches, conduced to the process and the consequent loss of gas.

Mr. Croll's system would, Mr. Cooper thought, be of much benefit, not only to gas companies, but also to manufactures generally, by reducing the cost of ammonia. Some years ago the price of sal ammoniac was 3*s*. per lb. for a quality inferior to that which was now sold for 6*d*. per lb. This reduction was entirely owing to the increase of gas lighting, the products being converted into this useful salt.

Among the manufactures in which sal ammoniac was used was that of tinning and zinking iron; it floated in a liquid state upon the fluid metal, preventing oxydation, and the plate traversed it before it reached the metal, when it was plunged in the bath of tin or zink.

The President observed, that Mr. Croll's paper was so important in its character, and the new process had been so fully and liberally described, that an obligation had been conferred, not only on the Institution, but towards the public, by its production. It was an additional proof, if such were wanting, of the intimate connexion of engineering with all the useful arts. From the purifying of gas, for domestic consumption, the transition was, it appeared, inevitable to the consideration of the chemical products of the process, and their influence on agriculture and horticulture, and the facts developed, were most interesting. He hoped that this discussion would prove an additional inducement to members, or to those who felt any interest in science, to bring forward papers at the meetings, as during their discussion useful facts would most probably be elicited.

In his connexion with the conservancy of the river Thames, his attention had frequently been directed to the nuisance, arising from the products of purifying, flowing from the gas-works into the river. He believed that the ammoniacal liquor was one of the most noxious of these products, and it would be no inconsiderable benefit, if, by

the adoption of this new system, by using dry lime instead of wet lime purifiers, this nuisance could be even abated if not finally got rid of.*

* In a recent communication from Mr. James Muir, New River Waterworks, he observes:—"The coal-gas may literally be said to saturate the ground in localities through which the pipes of several gas companies have been laid; and there it frequently effects an entrance into the adjacent water-pipes.

"When water services so situated are opened, they have been found to discharge no small volume of gas into one or more of the attached houses, followed by a small quantity of gas-impregnated water, which, being received by the cistern, serves to taint all the following supply, however pure. Not only is this discharge highly offensive, from its smell, but imminently dangerous, from its liability to produce explosion. A lighted candle is carried, without suspicion, to the water-cistern, where, least of all, any highly inflammable matter is expected, and an explosion ensues, with a violence, which the large admixture of atmospheric air greatly augments. In this way serious personal injury, as well as damage to property, has been occasioned.

"In seeking a remedy for the evil, the gas companies have been urged to search for their leakages, whilst the affected service (naturally supposed to be itself defective) has been at the same time stripped, in some instances driven anew, and proved, under considerable pressure, to be thoroughly water-tight, but all in vain.

"The circumstances which lead to the result under notice may thus be traced:—The service has one or more branches, which deliver themselves at a lower level than that which it occupies: as a consequence, whenever the supply has been intercepted, the water tends to fall out, and leave an unbalanced atmospheric pressure, by which the surrounding fluid, whether gas or air, is urged to enter, and which, being sometimes equal to a column of water, many inches in height, is capable of effecting the passage of gas in cast-iron pipes, apparently perfectly tight. The foul air, remaining in contact with whatever small quantity of water may be retained by the service, impregnates it; and both are ready to be driven into the most accessible cistern whenever the water is again turned on.

"This view of the matter induced the proposal of the following simple expedient, as a means of counteracting the evil; it has in several cases been applied, and in all with full success.

"From the highest part of the service affected by the gas, a wrought-iron tube, three quarters of an inch in diameter, strong enough to resist any tendency to form such a curve as would retain water, is laid evenly, and with an upward inclination towards the nearest protected situation, such as the side of a house, where it is made to terminate in a vertical piece, extending to any required height above the ground. On the top of this vertical piece is screwed the small float valve. The float forms the valve. It consists of a cylindrical piece of cork, in the axis of which a brass wire is fixed, to serve as a spindle for guiding it. The top is covered with leather, by which an air-tight joint is made with the aperture above, when the float valve is raised. There is a cover of copper, for the purpose of preventing the entrance of obstructions, but it is not an essential part of the instrument. The valve opens a free communication with the external air as soon as the water begins to fall out of the service, and by thus establishing an equilibrium between the fluids around and within, destroys any tendency which the former might have to force an entrance. As soon, however, as the service is again charged with water, the valve closes, and prevents all improper escape."

RECENT AMERICAN PATENTS.

[Selected from Mr. Keller's Abstracts in the *Franklin Journal.*]

MACHINE FOR FORGING AND SWAGING ANVILS. *John Taylor.*—The swages in this machine, as in all others, are made one movable, and the other permanent; the latter is called, in the specification, the bed: the two are so formed as to give to the anvil, when completed, the required curves, and to prevent this operation from forcing the surplus metal to the face, and rendering it uneven, there is a vertical rest, which is a continuation of the bed, against which the face of the anvil to be acted upon is placed. After the proper curves have been given to the anvil, it is secured in a double screw clamp jointed to the floor, and on each side there is a common anvil placed at such distance from the clamp, that the two sides can be forged alternately, without removing the anvil from the clamp.

Claim.—"I make no claim to the frame, hammers, and guides. What I claim is the bed on which the anvil is formed, shaped to correspond with the required form of the anvil, in combination with the vertical face, rest, or gauge, as set forth. Likewise, the jointed clamp in combination with the side rests, or anvils."

NEW COMPOUND, OR PAINT, DENOMINATED "THE INDESTRUCTIBLE CARBONIC PAINT." *Joseph Weisman.*—The patentee says, "The nature of my invention consists in combining the metal of carbon, or purified graphite, with caoutchouc and shellac, together with a small portion of acetate, or sugar of lead; the ingredients being mixed with linseed oil and spirits of turpentine.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of carbon, or pure graphite, with caoutchouc and shellac, together with acetate of lead, linseed oil, and spirits of turpentine for the purpose set forth, forming a perfectly indestructible anti-corrosive pigment, which also serves the purposes of anti-attrition."

IMPROVEMENTS IN THE LAMP FOR BURNING LARD AND OTHER CONCRETE FATS. *George Carr.*—This improvement consists in making the metallic conductors, or heaters heretofore used in lamps for the combustion of the concrete, or partially concrete, fatty materials, hollow, and so arranged as to heat them, and the air they contain. For the argand lamps the inner deflecting button, with its sustaining stem, are hollow, and at the bottom communicate with a tubular air space surrounding the wick tube, and from this a flat tube extends into the reservoir of lard, &c. This method of heating, or liquifying the fatty materials, is described as applied to a series of lamps with the common

burner. The lamps with their lard reservoir, rest on a hollow air vessel which extends up and surrounds them, so that the heated air may extend entirely around the vessels containing the lard, &c. This air vessel is to be heated by means of an auxiliary lamp below.

Claim.—" I do not claim to be the first inventor of lamps for this purpose, or of using conductors of metal for rendering the concrete materials liquid, by conveying heat thereto from the flame of the lamp; but what I do claim as of my invention, and desire to secure by letters patent, is the employment of hollow, or tubular conductors, within which the air is to be heated, and which hollow conductors, so containing heated air, are to surround, or to be surrounded by, the burner containing the wick, in lamps of the argand kind, and are to extend also into the reservoir, for the purpose and in the manner described. I likewise claim the applying of the heated air vessels, as modified and described; the said apparatus, under every change of form, being so constructed as to operate upon the concrete materials by the combined influence of good metallic conductors, and of heated air, and, substantially, in the manner made known."

MANUFACTURING SEAMLESS HATS, &c., OF LEATHER. *James S. and William Wibirt.*—A piece of leather of the required size, is put on the top of a hat-block, and bent down, and a string passed over it to hold in the folds which are then to be rubbed in, whilst in a moist state, with a scouring iron or tool, until the body of the hat is formed, and the rim spread out. After the hat has thus been formed and dried, it is to be rendered water-proof by a composition of linseed and neatsfoot oils and caoutchouc, and then coloured and varnished.

Claim.—" We do not claim, as our invention, the well-known process of crimping leather into various forms, as this has long since been known; nor do we claim the making of hats and caps of leather, as this has been done by sewing the parts together, so as to give the form required. What, therefore, we claim as our invention, and desire to secure by letters patent, is the new fabric described above, consisting of hats and caps, and hat and cap bodies made of leather without seam."

OPENING AND CLOSING BEE-HIVES, CALLED THE " BEE-PRESERVER." *Samuel Cope, and J. D. Cope.*—The hive is to be provided with a lifting gate, suspended by a rod to a crank, on the shaft of which there is a wheel with two stops on it, and a barrel with ratchet, cord and weights, like a clock, by which it is worked. A stop lever, projecting from an arbor, bears against the stops of this wheel, and prevents it from turning, except when lifted up at stated periods, which is effected by an index wheel, connected with a time keeper, and so formed that the attendant may change the periods of opening and closing the gate. The stops on the wheel are arranged one opposite the crank, and the other on the same side with it, that the wheel may be stopped either when the gate is up, or down.

The *claim* is limited to the index-wheel, and the stop-wheel, in connexion with a common clock, or other time-keeping apparatus, combined with the gate, for the purpose described.

IMPROVEMENTS IN THE HORIZONTAL PADDLE-WHEEL FOR PROPELLING VESSELS. *Peter Lear, and Ephraim Buck.*—This method of propelling consists of two rotating plates, arranged at the bottom of the vessel, one forward of the other, in the middle, and provided with hinged flaps, or paddles, kept close, or folded up even with the surface of the rotating plates, to which they are hinged, by the resistance of the water during a portion of their circuit, and thrown out by a cam, or inclined plane, during that portion of their circuit in which they are required to act on the water to propel the vessel. The inner face of each paddle is provided with an arm and roller projecting sufficiently to enable the cam, without projecting below the plane of the wheel, to open the paddle. The cams that throw out the paddles are so arranged, that their positions can be shifted at pleasure, and thus throw them out in any position relative to the length of the vessel; and in this way propel the vessel forwards, backwards, sideways, or quartering.

Claim.—" We claim the combination of the flaps, or paddles, (hinged to the wheel as described,) with the arms and the inclined plane, or cam, of sufficient length to keep the flaps open during that portion of their circuit in which they act on the water to propel the vessel, the whole being constructed as set forth. We also *claim* the above-described manner of arranging two sets of propellers upon a vessel; or with respect to the keel thereof, viz., the placing the one in advance of the other, and in a line, or range with the keel—or in the direction of the keel instead of the usual method of placing one on each side of the keel, and directly opposite to each other—the aforesaid arrangement effecting various important advantages in sailing and operating a vessel. We also *claim* arranging the frame or plate, of the inclined plane or cam, so that it may be movable, or made to turn on its axis horizontally, or in other words, we *claim* changing the horizontal position of the inclined plane or cam, the same being for the pur-

pose of throwing different paddles of the series into action, and thereby imparting to the vessel, or steam ship, a lateral, quartering or other desirable movement, as set forth."

IMPROVEMENTS IN MACHINERY FOR LAYING ROPE, AND FORMING, OR WINDING, THE SAME INTO COILS FOR TRANSPORTATION, OR STOWAGE. *Stephen and James A. Barin.*—The bobbins with the strands are placed in flyers that travel about a common centre, and rotate on their own axis. The strand from the bobbin passes over a guide, thence around a grooved wheel on a hollow shaft, through which the strand passes to the layer on the end of the main shaft. The hollow shaft has a pinion on it which gears into a cog-wheel on the layer shaft, and the diameters of the pinion and cog-wheel regulate the quantity of yarn to be given out by each revolution of the flyer. There are as many of these flyers as strands in the rope to be layed.

The rope from the layer passes over a drum which regulates its delivery, and from this it passes under and over two pulleys on the vertical shaft of a crane, and thence over a pulley on the end of the long arm, or boom of the crane, which delivers it on to a reel, and as the crane turns freely on journals on the ends of its vertical shaft, the end of the arm or boom, which carries the rope, is free to move and follow the coils formed on a reel immediately under it.

Claim.—"Having thus set forth our invention, we shall claim the manner of regulating the drawing of the strands from the bobbins, viz., by means of the series of gear wheels, hollow shafts, grooved wheels and guides intervening between the layer and bobbins, the same being substantially as set forth. Also the mechanism for guiding or distributing the rope upon the coiling reel, the same consisting of the reciprocating crane applied to, or used, in connexion with the reel, and constructed and operating substantially as described."

IMPROVEMENT IN THE MACHINE FOR PREPARING HEMP, AND OTHER FIBROUS MATERIALS FOR SPINNING. *William Montgomery.*—This is an improvement on that part of the machine which combs the slivers, by means of "gill pins," on their passage to the rollers and spindle. The gill bars are formed into two endless chains, as is well known to those acquainted with this branch of manufactures, and the improvement in question is to cause the teeth in leaving the fibres, as they pass round the drum to return, to continue vertical until after they leave the fibres, which is effected by means of a projecting stud on the end of each of the "gill bars," which is guided by an inclined plane attached to the frame.

Claim.—"I claim the combination of a projecting stud on one end of each of the 'gill bars,' with a stationary inclined plane, or other suitable bearing stop, attached to the inside of the frame work, which combination causes the 'gill bars' to turn so much in their bearings in the chain belts, as to make the heckling pins leave the sliver vertically, and without breaking the fibres of the hemp, the whole being as set forth."

IMPROVEMENT IN THE WATER-WHEEL FOR MILLS. *Jesse Taylor.*

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before described construction of the water-wheel, in combination with the trunk, collar, and shoot, for admitting the water through the centre of the bottom of the wheel to the interior thereof, and causing it to escape near the circumference through small apertures, which has the effect of turning the wheel in a contrary direction to that of the escape of the water; that is to say, combining with the trunk, collar, and shoot, as aforesaid, a hollow drum, or wheel, constructed with a circular rim, and a concave convex head, fixed to said rim, and to which head the shaft is fixed; and with a bottom which is also fastened to the said rim with a circular aperture in the centre of said bottom for the admission of water, and a series of small apertures near its periphery, in a circle concentric with the circle of the centre aperture for its discharge, the interior being hollow, with a rim made in segments, or less than the outer rim, arranged in a circle concentric with the outer rim, forming a space between the two rims in which are arranged inclined planes over the before mentioned small apertures, the approach to which are also inclined planes formed on the bottom, over which vertical heads are fixed, between which and the last mentioned inclined planes the water passes to the issues from the centre of the wheel through spaces in the inner segment rim, as described."

We deem it unnecessary to add any descriptive remarks.

IMPROVEMENT IN THE LAMP FOR BURNING VOLATILE OILS. *Isaiah Jennings.*

Claim.—"What I claim as new, and desire to secure by letters patent, is the employment of two separate reservoirs for the supply of a lamp or lamps, which reservoirs are to contain volatile ingredients of different natures, and which volatile ingredients are to be conducted into separate chambers in the burner, in which chambers they are to be evaporated, and their vapours are to be made to comingle in a gas or vapour chamber, whence it is to escape through suitable holes, for the purpose of being ignited; the respective parts of the apparatus for effecting this

object being arranged and combined substantially in the manner set forth."

IMPROVEMENT IN THE LAMP FOR BURNING LARD, TALLOW, AND OTHER KINDS OF FAT. *Moses S. Woodward.*—The body of the lamp, which contains the lard, and which receives the burner, is so jointed to a stem or stand, as to admit of being tilted to any desired extent. By this means the lard can be burned until it is nearly exhausted; for, by the tilting of the body of the lamp the lard can be brought near to the ignited part of the wick. A metallic conductor is employed in the usual way, and extends from near the flame to the bottom of the body of the lamp, for the purpose of keeping the lard, &c., in a fluid state.

Claim.—After disclaiming the use of a metallic conductor in a lamp, the patentee says, "I claim the so constructing of a lamp for burning materials of the kind above named, as to combine with the said method of keeping the materials fluid, the means for tilting the body of the lamp in any required degree, for the purpose and substantially in the manner described."

THE SCREW-PROPELLING PATENTS.

Court of Queen's Bench, Dec. 16, 1844.

(Before Lord Denman and a Special Jury.

Lowe v. Penn.

Mr. Jervis, Mr. Serjeant Byles, and Mr. M. Smith were for the plaintiff. Mr. Platt, Mr. Martin, and Mr. Peacock for the defendant.

Mr. Jervis stated that this was an action to recover compensation for the infringement of a patent. The plaintiff was by trade a smoke-jack maker, and a man in humble circumstances, but possessed of great ingenuity. On the 24th of September, 1838, he took out a patent for a propeller for steam-boats, constructed on the principle of a screw. A cylinder, to form an axis, ran along the bottom of the boat, and projected beyond the stern, and on this projecting part were placed curved pieces of iron, so arranged that the line on which they were placed would, if continued, form the thread of a screw along the cylinder. The screw itself was not new; but the plaintiff's discovery was in curving the blades fixed on the shaft, in having them arranged on the line of a screw upon it, and in having them all under water. The defendant had fitted out two vessels for Egypt on the plaintiff's plan, and having done so without a license, had committed an infringement of it. If the defendant had been permitted to follow the inclinations of his own honourable mind, he would have arranged the matter, as he once intimated his intention of doing; but it would seem that he had been persuaded to dispute the novelty and the usefulness of the plaintiff's invention. This action was brought for the purpose of settling that question, and the evidence would be such as to entitle the plaintiff to a verdict.

The Specification was read. It described the invention as consisting in a method of propelling vessels by means of one or more curved blades, set or affixed on a revolving shaft below the water line of the vessel, and running from the stem to the stern.

Mr. Carpmael, C.E.—I believe that the plaintiff is the true inventor of this improvement. I have examined his specification. He therein states clearly in what point his improvement consists. I consider the axis being below the water line an improvement. I am not aware of any case where the segments of a screw fixed on an axis, revolving below the water line, were used before the patent of the plaintiff. I went once, by appointment, to the defendant's factory at Greenwich. The defendant explained to me that he had constructed two vessels with propellers, and the drawings of them were shown to me. I examined them, and told him that I considered they were infringements of Lowe's patent.

Cross-examined by Mr. Platt.—I am aware of Shorter's patent in 1800. It was an application of blades or segments of a screw. I never saw Lowe's patent applied to any vessel in the water. The angle in which the surface is inclined to the cylinder for the formation of the screw is not stated in the Specification. Engineers differ as to the most efficient inclination, but about 30 degrees is generally considered the best. The model of the screw which was used by Mr. Penn, the axis of which lies horizontally in the vessel, would, if working vertically, perpendicular to the horizon, be the same thing as a smoke-jack, except that in the latter case the interstices between the blades, or sections of the screw, would be filled up by vanes. I am not aware that any vessel was ever constructed under Shorter's patent of 1800, or Millington's of 1816. I never personally tried any one of the inventions to which I refer.

Re-examined.—A smoke-jack is not formed of the segments of a screw, but of planes. By copying the smoke-jack entire, we should have a choking action; by taking the alternate leaves, we then have Lowe's plan, and the water can leave the propeller freely. I never examined a smoke-jack with sufficient minuteness to say whether the blades are curved.

By Mr. Platt.—Have you ever seen Brown's plan?—No; I know that he had a plan, and think it was like Shorter's. You know nothing, then, it seems, of any plans before Lowe's patent. Pray let me ask you whether you know anything of Trevithick's? —No. Of Millington's?—No. Of Cummerow's patent?—Yes. Is it not a screw produced by turning an inclined plane round a cylinder?—It is. And how does this propeller act? Is not the water the female screw, in which the male screw acts?—It is, if we call the whole body of it a screw.

Lord Denman.—A corkscrew has no cylinder.

Mr. Platt.—I want to know what effect the blades would have if placed in the direction of the axis of the cylinder, so that they would strike the water flatwise?—They would only stir up the water. In this patent I say that the curvature is on the face of the blade. The specification says that the blades are to be such, that being continued round the axis, they will make a screw. Shorter's patent was taken out in 1800; only one on his plan was constructed, and that was in 1816. The vessels in which Mr. Penn had placed the propellers were called the *Infant Prince* and the *Nile*.

Mr. Joseph Briggs.—In January of 1843 I went to the defendant's. I had an interview with him. I told him that he was infringing plaintiff's patent. It was then agreed that we should leave it to Mr. Carpmael, who pronounced an opinion that the screw used by the defendant was an infringement on plaintiff's patent. Defendant had fitted out the *Infant Prince* and the *Nile* with this screw. They were vessels sent out to Egypt to navigate the Nile. Defendant said, that as he was in partnership with his father, he should speak to his father, before he could ultimately settle the matter. Defendant said he did not wish to infringe any other man's patent, and he would not put another screw into a vessel without some arrangement. I saw defendant after the death of his father, at his solicitor's. I then said that as the defendant admitted he had infringed the patent without knowing it, I would meet him in an equally gentlemanly way, and that nothing more should be said about that if he would give the plaintiff 5*l.* It was said that I could not have spoken more fairly. Defendant then went out of the room with his solicitor, and afterwards came back, and said he would not take a license unless it was embodied in the license that he did not admit the patent. He was willing to pay the 5*l.* for what was past; but it was said that Mr. Penn, standing in the eminent position he did as an engineer, would not like to admit the validity of the patent, for he might be called on at some trial to speak to the matter. The arrangement did not take place. When I saw Mr. Penn, he did not tell me that his machine was upon the principle of the windmill or smoke-jack.

Cross-examined.—I had at that time an interest in the patent. I have since parted with that interest for the purpose of being a witness in this case. I rely on plaintiff's honour to restore to me my share of the patent when this trial is over. At that period I had 7-12ths of the patent. I had been then interested in it for six months. The patent had been pirated often. Plaintiff had put the patent on the *Cycloid*, formerly the *Wizard*. Smith, who invented the whole screw, and Wimshurst, who built the *Archimedes*, knew of the *Cycloid*, and went in it. It was a vessel used to prove the applicability of the plaintiff's screw. The vessel has been broken up. The plaintiff's screw is now used in the *Rattler*, also in the *Phœnix*, which are Government vessels. The Government has not paid anything for a license. Till the matter is settled by action no one will admit the patent. I do not know who superintended the building of the ship, but Mr. Lloyd, I believe, put the screw on the *Rattler*. I saw Mr. Lloyd at Sir Edward Parry's. Defendant told me that he had built two vessels for the Pacha of Egypt to go on the Nile. Defendant said he had never read the patent of the plaintiff.

Mr. George Bethell.—I am an engineer, in the employment of Messrs. Flockton, of Bermondsey. Plaintiff was in that factory. His masters interested themselves in this patent, and purchased a small steamboat, the *Wizard*, afterwards called the *Cycloid*, for the purpose of trying it. We worked the screw with one, two, three, and four blades. They were on a fixed axis, and placed on such a line as, if continued, would produce a screw, and act below the water. We set the blades at different angles to suit the engines, varying from 22° to 30°, 35° and 42°, to suit the engines. We found 30° about the best angle. We had twelve-horse engines, but the boilers did not produce more power than seven and a half horses. The vessel was of twenty-five tons. The vessel went about seven miles an hour. Tried it in the Commercial docks at Deptford; also at Brentford, and once at Gravesend. That is a good rate of velocity for such a small power. We put on a false stern for the propeller to work in. The axis passed through a stuffing-box, which is a box filled with grease, so that though under the water-line the axis was kept free from the water. These trials were in 1839

and 1840. I am not sure that we did not make them in 1838. I saw the *Archimedes*. The plaintiff and a person since dead were with me. There was at first a place left for the propeller. The *Archimedes* had two blades, each of which was a half turn of a double-threaded screw. I saw Mr. Francis Pettit Smith. He had been on board the *Wizard*. After the *Archimedes* returned from Oporto, I called on him to remonstrate about the use of the propeller in that ship.

Cross-examined: I have seen Shorter's plan. The axis and blades work with ease under water. I think it was generally at the bow, the axle inclined downwards. I believe it does not signify what the power is which turns the axle. I believe the stuffing-box was new as applied by Lowe. When we went with two blades we increased the amount of surface; the two blades were about 12 inches broad, and 15 inches long. We made no calculations to arrive at the correct size; perhaps Mr. Lowe might. Do not know whether Lowe saw Shorter's model.

Thomas Miller, an engineer, late with Messrs. Rennie, and in their employment during the fitting of the *Archimedes*. The improvements in the specification of Lowe were new, and were an improvement upon propellers fitted up with a whole screw. The whole screw was originally used in the *Archimedes*, but they afterwards substituted a half-turn of a double-threaded screw, which requires about a tenth less horse-power, and worked in a great degree without the choking action of the whole. In a screw made according to Lowe's patent, the choking would be got rid of; it was, indeed, wholly removed when the plaintiff Lowe's screw was used, and the vibratory motion also ceased. The merit of Lowe's invention consists in having a curve on the face of the blade. Perfectly flat blades form no part of his invention. By flat plates I mean plates similar to the common smoke-jack. I never knew of fixed blades revolving on an axis *below* the water previous to Lowe's patent. The plates in Hunt's propeller* are certainly curved.

Mr. Platt then addressed the jury for the defendant. After taking several objections to the specification, which, he contended, was not made out by the evidence to be correct, and animadverting with severity on the evidence of the plaintiff's witnesses, the learned counsel proceeded to direct the attention of the jury to the different screw-propellers preceding those of Lowe, and particularly those of Shorter, 1800; Trevithick, 1815; Millington, 1816; Brown, 1825; and Cummerow, 1829. Millington had done more than Mr. Lowe, for whereas Lowe gives you no angle, while Millington states that the blades should be placed at an angle of 45° with the plane of motion. Millington also makes a provision against the *choking* of the water, by stating that the blades must not extend to each other, but have spaces, so as to allow the free escape of the water. He adds, farther, "I will show the manner of working *the axis through a stuffing-box*." Brown had obtained for his invention a reward which was offered in the *Times* newspaper for the best method of propelling vessels without paddle-wheels. He had been publicly rewarded for that invention, and the public has the right, unpaid for, to use it. He propelled vessels by the working of vanes, or portions of a screw. Was not this the same as Lowe's? Was it not used for the same purpose? The vanes were placed in the same way, with the addition of the great improvement in cutting away portions of the vanes towards the centre. Cummerow's, too, was a screw, but the portion of the thread of a screw placed between the stern-post and rudder, and provided also with a stuffing-box. The learned counsel stated that he held also in his hand reports of Ericsson's propeller, and its successful application, (exhibiting a number of the *Mechanics' Magazine*.)

Sergeant Byles objected that the defendant had received no notice of Ericsson's invention being intended to be relied on, and the court held that the plaintiff could not be allowed to go into it.

Mr. Platt. The defendant was unwilling to infringe any man's patent, and he should contend that he had not done so in this instance. The plaintiff had not, in fact, made any new discovery, nor had the defendant taken that discovery, whatever it was. The defendant's vessels were fitted, not with curved, but with straight blades, and the thickened part, which the plaintiff and his witnesses fancied to be curved, was only thickened for the purposes of strength, and was not curved at all. He should establish these points of defence, and the jury would have no difficulty in finding a verdict for the defendant.

Mr. Matthews produced examined copies of Shorter's specification, 1800; Trevithick's, 1815; Millington's, 1816; and Cummerow's, 1828. I was in the defendant's factory when the propellers were put into the *Infant Prince* and the *Nile*. This is a model of the propellers. There is no concavity in Hunt's blade; it is nearly

* This is the propeller, Mr. Penn's use of which forms the subject of the present action: for a full description of it see *Mechanics' Magazine*, vol. xxxiii., p. 33.

straight. It is thicker in the middle. That is for strength.

Mr. George Rennie: I am an engineer. I have paid attention to the mode of propelling vessels by the screw. I have done so from the time of the *Archimedes*, which might be in the year 1838. I have examined this propeller of the plaintiff, and of the model of the two vessels sent to Egypt. The principle of the form here is the action of the angular surface against the water. It is nearly the same as a windmill. That is a screw. This model has no principle of the screw. The centre of pressure here would be near the extremity. In the windmill there is a curve on the face of the sail. That is quite an old principle. The only difference here is that the operative part is flat and not curved. I am acquainted with Shorter's patent. There is no difference in principle between the propeller of Shorter and the defendants; the application was different with Shorter's. I cannot say for certain whether Shorter's was wholly immersed. I am acquainted with Millington's patent. There is no difference between that of the defendant and Millington's propeller. I know Brown's boat; the propeller there would not operate to the best advantage; it would not form a screw. The blades are placed at an angle to the axis. The principle there is the same as that used by the defendant. It is the same as Trevithick's. Cummerow's is a screw round a shaft. The principle is the same, whether used at the stern or stem, and whether plain leaves or screw-leaves be used. There is nothing new in using them entirely below the water-mark. They have been used before 1838. All these allow of the water passing away, so as not to choke the propeller, which the complete screw does.

Cross-examined by Serjeant Byles.—In Shorter's the blades are set out. The axis is above the water, and the blades appear flat; but it does not follow that the blades should be out of the water, as this is amply allowed for by the universal joints he makes use of. In Millington's patent the leaves are like those of a smoke-jack. The axis need not be above the water on account of the stuffing-box, which is there, however, shown just above the water-line. In Shorter's the axis is above the water-line; but it does not follow that the propeller-blades should be out of the water at any portion of their revolution. Mr. Millington's could be worked by guy-ropes or lines, steering the vessel at the same time. I never saw either of these patents in operation. I have seen the model of Brown's gas vacuum engine: there is a universal joint, but guy-ropes are unnecessary, as applied by Brown according to his model. I know the way in which a smoke-jack is constructed. Cummerow's patent represents a whole screw. I do not know Trevithick's plan. I observe in Lowe's a concavity and a convexity, the necessary attendants upon the screw. In Hunt's propeller, as constructed by him, if the plates were of the same thickness, there would be as much concavity as convexity; but this would not produce a screw. Hunt's propeller forms no part of a screw; the blades at the outer extremities, and for some considerable distance down, are no portions of a curve. The curvature in Lowe's is very considerable: at the same distance from the centre Hunt's is a curve, but the reverse way.

Re-examined by Mr. Platt.—A concave surface cut in the form of a screw would trace out the thread of a screw in its progress. Trevithick's blades, or leaves, were placed round an axis like the common smoke-jack. The object of the convexity in Hunt's is simply to give strength, the blades themselves are actually flat; their being convex on both sides necessarily follows from their being thickest in the middle, or part nearest the boss.

Mr. Samuel Brown.—I am a maker of iron casks. I was in 1825 employed by the Gas Engine Canal Company to make propellers for a canal-boat. We bought a boat, and fitted her with a whole screw. That was in 1814; but bit by bit I cut away parts, and got to have only segments of a screw, and I then came to the conclusion that segments of a screw are the best. That was in 1825. All propellers of this kind, however you may vary them, are a screw. I had the blade curved, so that, if extended, it would have produced a screw. I applied the blades at the bow and also at the stern. We had a trough in which the models were placed for trial, and we had a *stuffing*-box in the stern. In the model here (referring to the original model of his screw-boat) the plates are flat, but it is like a screw when in action. My propeller acts on the principle of the screw. The engine was a gas-engine; the engine was not brought to perfection. The boat was tried in Grosvenor Basin; also in the river at Brentford. The company afterwards sold the vessel, and I bought the propeller and engine. I had another boat built by Honey and Archer of Lambeth, and I tried experiments in her until 1829. I did not use a universal joint, but I *did* use a stuffing-box. I set the blades to an angle of 25°, and had the plates curved, so that in action they produced a screw. The boat was free to any one to come on board, and hundreds availed themselves of the opportunity.

Cross-examined: I did not buy this mo-

del of Mr. Shorter. I employed him to make it. I got a reward. I gave him no part of it. In my opinion flat blades would form a screw, but I am aware that some mathematicians differ from me in opinion on this point.

Re-examined: The axis passed through a stuffing-box, which was below the water. The vanes were below the water. There was a part above the water-mark.

Mr. John Farey examined.—I am a civil engineer. I have been in business 38 years. I have examined Lowe's specification; it is so badly drawn, and so vague, that it would puzzle any one to understand it. (Here Mr. Farey read the specification.) Now, it is difficult for one to know what he means by *curved* blades. He might mean curved in contradistinction to straight—as, for instance, a straight sword and a scymeter; but it is not probable that he meant this. If we are to take the word in its literal sense, I do not then understand his meaning. I understand, in technical language, that a thread wound round a cylinder in the form of an inclined plane makes a perfect screw; but this is one drawn so that you cannot say whether it forms a screw or not. The two blades are not a screw; they may be portions of curves, which, if continued, may form portions or segments of a screw; and motion being given to the propeller, causing it to rotate on its axis, they may form part of a double-threaded screw, which is a thing perfectly and clearly understood by all who have any knowledge of mechanics. But the drawings of Lowe are so inaccurate, so faulty, so bad, that no dependence can be placed upon them. In his drawing he shows his *scymetar*-shaped propeller; but in one case the blade is going foremost, and in the other the reverse. It may be of 4 blades, which may be, therefore, considered parts of curves, which, if combined, would form a 4-threaded screw; but it would then, in becoming a 4-threaded screw, be a screw of so small a pitch that the action would be deteriorated. In this model (Lowe's with 4 blades) they would not produce a screw; the angle of obliquity is not shown—a state of things which is all important. This model (pointing to one) shows the portion of the lines of a 4-threaded screw, the axis being absent. I know Shorter's patent; I have seen a model, or rather a real machine, on a diminished scale, of Hunt's propeller. In the shaft and in the axis there is no difference between Hunt's and Shorter's, with the exception of Shorter's having but two blades, which he assimilates to a windmill. They are not curved but twisted at the outer extremity; they are perfectly flat; in its motion in rotation round its axis it would produce a screw; the curvature, however, is very slight, and here toward the outer extremity almost insensible. Take it another inch towards the centre and the curvature would alter, and this curvature would be constantly varying the nearer we approached the axis. *Convex* and *concave* are both curved surfaces. By a curve—by a regular curve—I mean a line that would extend to infinity. Shorter's patent was for 2, 3, 4, and 6 leaves. Shorter's propeller was submerged but partially, I imagine, and not in a true or correct horizontal position; but, in his drawing, the propeller is not seen at all, being entirely under water. Millington was the first that invented the stuffing-box. Shorter, having no stuffing-box, was obliged to place his propeller at an angle, instead of in a horizontal position, or in a line parallel to the vessel's keelson. I expect he meant to have his shaft horizontal, but the words of his specification are also vague; they are not correct; they do not describe his meaning clearly and precisely. In Millington's, the vanes could be used for the purpose of steering by means of guy-ropes, like those placed on the boom of a ship, and worked either way by means of those guy-ropes or guys. If a vessel were constructed with a stuffing-box like Brown's, it would be identical with Penn's. In the case of Lowe, he does not state whether the axis is under water. In Trevithick's, he mentions that his vanes are similar to the vanes of a smoke-jack. The principle, therefore, in this is also precisely similar to Penn's. He does not mention a stuffing-box, but it necessarily follows that there was one—the axis revolving or rotating *below* the water-line. In Mr. Penn's the windmill principle is carried out. In Cummerow's patent the axis is stated to be under water, the propeller also, and the whole of the axis. It is not right, in strictness of language, to say that the whole of the axis is under water, that portion of the axis included in the gland not being under water. The whole or complete screw used by Cummerow is not so good as the divided one. The cause of one working better than the other is this, that it operates on the same water for too long a time, giving it a revolving-circular, or whirling motion, not clearing away thereby sufficiently soon to allow fresh portions of water to be acted upon. It has been my duty to investigate the history of this plan, and those are my ideas upon the defective or non-useful effect of the whirling motion. The *whole* screw came up with Cummerow's patent, those propellers previously tried being mere segments, or divided screws. I know the form of a smoke-jack. Mr. Penn's differs essentially from a smoke-jack. If you take out every other vane of the smoke-jack, then

it approaches the windmill shape — this clearing away and dissevering every alternate vane, so that each part may meet with fresh water to act upon. Shorter's, Trevithick's, and Millington's, are identical with the propellers used by Mr. Penn. The propeller, as here shown (holding up a model), is strictly in the manner of a smoke-jack; but a smoke-jack would be a bad propeller. Hunt's, by being thinned off to the edges, are prevented from being a screw.

Mr. Joseph Field, of the firm of Messrs. Maudslay, Son, and Field:—I have turned my attention to this case, and Mr. Hunt's propeller coincides with Shorter's, Trevithick's, and Millington's; there is no difference in the principle. I never saw Brown's boat, but, from his description and model, it is identical with that of Mr. Penn's, fitted to the *Infant Prince* and *Nile*, —the blades propel by their oblique action upon the water. I see nothing new in Lowe's patent. I believe the stuffing-boxes and submerged propellers are not new in Lowe's patent; the principle was Shorter's; his patent was upon the principle of the windmill. I fitted sections of a screw to the dead wood of the *Rattler*, and it has been found to answer with the axis below the water line, in the dead-wood. We had orders to do so from government. The curve for this propeller was two half turns, each of them being portions of a screw, wound spirally round a cylinder; they were precisely in this form, (showing a model) or wider at their outer diameter than at the base.

Mr. Elijah Galloway.—I am a civil engineer. I have found great difficulty in making out the meaning of Lowe's specification. It gives no information as to the direction of the curves, which, if continued, were to produce the screw; it might as well be radial as spiral. The invention was by no means new. He had known the same thing long before Mr. Lowe's patent. Had applied his attention particularly to screw propelling.

Cross-examined: Has been twenty-one years an engineer; was the author of Appendix D to Tredgold; is acquainted with the patents of Shorter, Trevithick, Cummerow, and Lowe. I gather from Lowe's plan generally, that he means a helix. The use of the screw as a propeller was most unquestionably old; also sections of it as shown. Neither is the screw new to me, applied submerged, and with its axle through a stuffing box, with segments. Mr. Penn obliged me with one of the arms from the *Infant Prince*, and I found it not curved so as to produce a screw. The extremities are flat; a curvature is perceptible towards the boss, produced by the thickening for the purpose of strength. The plates are in themselves flat, and would not act as a screw. Mr. Penn's flat blades in revolving would produce an ellipse, but in its progressive motion would form a helix; without motion it could not cut such a screw. I saw in 1837 Ericsson's propeller, which complied in all conditions with the segment of a screw—only being much superior to Lowe's, as I conceive.

Mr. Penn has done nothing that is new. Screw propelling is still in its infancy. We have not yet arrived at the best form of screw or segment. Men of ingenuity have long turned their attention to it, and they have arrived already at the conclusion that segments are unquestionably superior to whole screws, and I have known them as such since 1837. I made a whole screw, or two segments, or, in ordinary language, they were about two-thirds. I made this screw in 1839; it did not fail, but was not proceeded with owing to the bankruptcy of a party interested. Shorter's patent had an outrigger, and the shaft proceeded from the water in an oblique direction to the water; if it had been used in conjunction with steam, it would have been efficient. The greatest defect in it would be the use of the universal joints. It is an improvement to give motion to an axis below the water in a straight line.

Cross-examined by Serjeant Byles: In the propeller used by Mr. Penn the blades are unquestionably bent, but not over the whole surface; the flat part, I should say, extends fully half of the entire surface, and this is caused by the strengthening of the parts. Stuffing-boxes were known prior to 1838.

Mr. Serjeant Byles replied at length, on the part of the plaintiff.

Lord Denman then summed up the case to the jury, who returned a verdict for the plaintiff—Damages, 40s.

[There never was a verdict more contrary to evidence, and, what is more, to fact. Had the line of defence been more strictly confined to showing, that whatever the plaintiff's claims may be, as to the use of curved blades, Mr. Penn did not employ curved, but straight blades (on a line from the centre of the shoulder to the circumference) the result might have been different.—Ed. M. M.]

Errata.—In Mr. Dircks's letter of November 18, page 366, for "June last," read "February 3rd.;" and for "nearly six months," read "nearly nine months."

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CHATTEN'S PATENT DEAD-EYE.

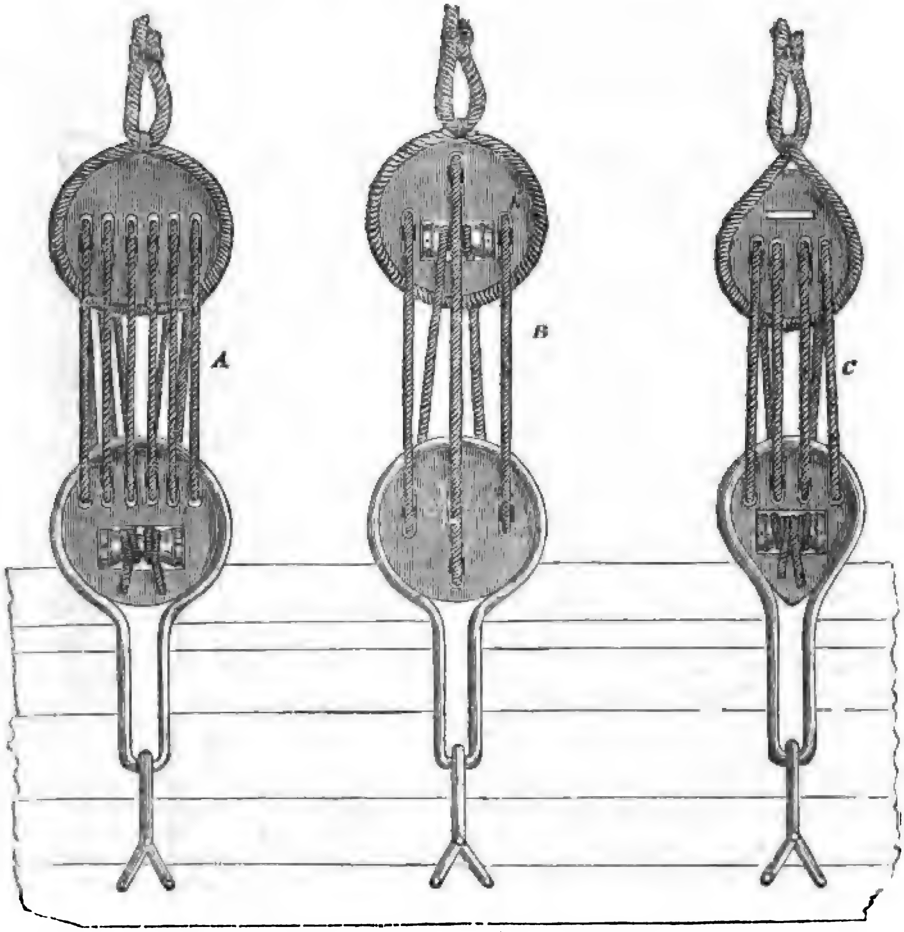


Fig. 3.

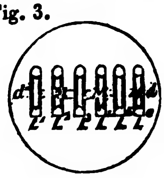


Fig 4

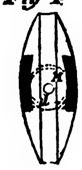


Fig 2

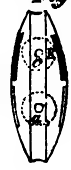
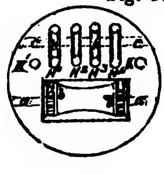


Fig. 1.



CHATTEN'S PATENT DEAD-EYE FOR SETTING UP THE RIGGING OF SHIPS.

[Patent dated, May 22, 1844; Specification enrolled, November 22, 1844.]

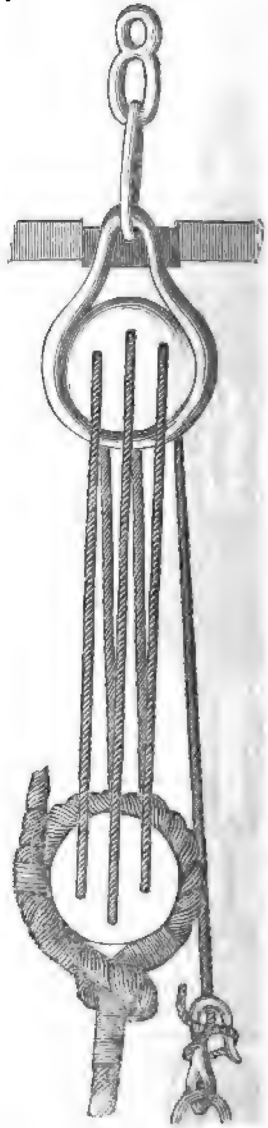
To enable the reader fully to understand and appreciate the merit of the present invention, it will be proper first to describe briefly the means now employed for setting up the rigging of ships, and to point out the disadvantages to which it is subject. The opposite figure is a representation of the dead-eye now in general use, which must be familiar to every one in the least acquainted with shipping.

The great and obvious fault of this mechanical agent is—the direct nature of its action. The manual strength required to work it is excessive. As in many other cases, the force of a lad suffices, with the aid of intermediate machinery, to raise a weight which an able-bodied man could not do by a dead lift, so in this we commonly see two or three men labouring hard at what any cabin-boy could, with suitable mechanical appliances, readily accomplish. Again, this direct mode of action admits of but one, or at most two shrouds, being set up at a time; so that the whole weight and stress of the masts, rigging, yards, &c., have to be borne for the time by that single shroud, or couple of shrouds—a task to which they but too often prove unequal. So great is the danger from this cause, that experienced seamen always choose calm weather for setting up their rigging, and never think of attempting it in rough.

Mr. Chatten—a master mariner of long and extensive experience—has, by an ingenious combination of the power of the capstan with that of the dead-eye, successfully obviated all these objections. He admits that it has been before proposed to have recourse for this purpose to capstan power, and confines his claim to originality to the particular modes by which he makes it available.

These modes are three in number. The first is represented in figs. 1, 2, 3, 4, and A, of the accompanying engravings. Figs. 1 and 2 are front and edge views of the lower dead-eye of a set; figs. 3 and 4 front and edge views of the upper; and fig. A shows the manner of setting up the rigging of ships, by means of these dead-eyes. Both eyes are of a flat circular form, bulging outwards in front and back, and grooved on their peri-
the reception of the shrouds. The lower

pheries (like the common dead-eyes) for
dead-eye is intended to be secured as



usual to the chain plates on the sides of vessels. In the middle of it, and nearer the bottom than top, there is an open rectangular space, in which is inserted a capstan, which turns freely on an

axis *a* passed through the dead-eye and capstan from side to side. This capstan approximates in form to that of two cones placed apex to apex, and carries two ratchet wheels, one at each end, with holes, *b b*, in them for the reception of the capstan bars. G G are palls let into the body of the dead-eye, immediately over the ratchet wheels upon which they are intended to act. H^1 H^2 H^3 H^4 are four rectangular openings in the top of the dead-eye, in which are inserted four grooved pulleys, which turn on a common axis, *c*, shown by dotted lines, passed through the dead-eye and pulleys from side to side. K^1 K^2 are two plain holes, one on each side of the pulley openings. The upper dead-eye, round which the ends of the shrouds are to be passed, has six rectangular openings, L^1 L^2 L^3 L^4 L^5 L^6, in the centre of it, (similar to those of the lower dead-eye) in which are inserted the like number of grooved pulleys, M, having a common axis *d* (shown by dotted lines) passed through the dead-eye from side to side. To connect these dead-eyes together, one lanyard is first brought through the hole K^1 of the lower dead-eye, and secured to the back thereof by one end which is knotted for the purpose; it is then passed successively through the openings of the upper and lower dead-eyes, marked L^1 H^1 L^2 H^2 and L^3, taking into the grooves of the pulleys in each opening; after which it is drawn down to and through the rectangular space, and carried once or twice round the capstan, at which point it meets another lanyard, which has in like manner been rove successively, but in the opposite direction, through the openings in the upper and lower dead-eyes marked K^2 L^6 H^4 L^5 H^3, and L^4, and over the pulleys within them respectively (the opening K^2 only excepted). When the rigging is to be set, one person takes fast hold of the two ends of the lanyards hanging from the capstan, and another works the capstan; or where great force is required the capstan may be worked by two hands, one to each wheel. Every time the capstan bar or bars are taken out the palls lay fast hold of the ratchet wheels, and prevent any purchase which is once gained from being lost. The power which two or three hands are enabled by these means to exert in setting up the rigging, is greater than many hands can exert with the common dead-eyes, and in some instances than is to be obtained at all in the ordinary way.

The *second* variety is precisely similar in respect of its mode of action to that which has been just described, but it differs from it in the following points of detail:—First, the capstan, instead of being fixed in the lower dead-eyes, is fixed in the upper. Second, instead of 4 openings in the lower dead-eye and 6 in the upper, with pulleys in each, there are only 3 in the former and 2 (with a plain hole, K^3, having no pulley) in the latter. Third, the pulley openings are arranged differently. And, fourth, instead of 2 lanyards, 1 only is made use of, which is first made fast by knotting as before to the back of the plain hole K, and then rove successively through the different pulley holes till it is wound round the capstan.

The *third* variety, marked C, is also worked on the same principle as the two others, and with the capstan in the lower dead-eye and two lanyards as in the first case; but, first, the dead-eyes are of an oval or pear-shaped form, instead of being circular; second, there are but two openings with pulleys, and two plain holes, in the lower dead-eye, and four openings with pulleys in the upper dead-eye; and, third, each lanyard is made fast at its lower end by a loop to one or other of the plain holes, and then rove through three pulley holes, two at top and one below, before it is wound round the capstan.

In all the three varieties the parts may be made either of wood or metal, with the exception of the axes and bushes of the capstan and pulleys, and the ratchet-wheels and palls, which must in every case be of metal.

COUNTERFEIT TRADE MARKS.

A case of some novelty was recently tried in the Circuit Court of the United States. A person named Daniel Carpenter had manufactured and sold a certain description of cotton thread, which was marked as, and represented to be, the "Persian thread," manufactured at Leicester, in this country, by Messrs. T. and W. Taylor, though much inferior to it in quality, so that the reputation and business of Messrs. Taylor had suffered injury thereby. One of the pleas set up by the defendant was, that he was not accountable to an alien and foreigner for using in America the trade marks of such alien. The court granted to the complainants a perpetual injunction against the defendant, with costs. The result of this judgment is to show, that in the United States foreigners are fully protected against this species of injury.—*Liverpool Albion.*

THE PATENT VENTILATORS—GLASS LOUVRES, PERFORATED PLATES, AND WIRE-GAUZE.

Sir,—In the comparison instituted at page 387 of your 1113th Number, between Fair and Co.'s patent ventilators (the *glass louvres*) and the perforated ventilators of Dr. Guy, the former are not quite fairly dealt with. The *glass louvres* are correctly described as "the most elegant invention of modern times;" their expense is certainly against them, and to some extent limits their employment. Their great and unquestionable superiority over every other contrivance for a like purpose, notwithstanding their costliness, leads to a very extensive demand, while the efficiency of their action gives universal satisfaction. In the article above alluded to, it is stated of Fair's ventilator that "it does not prevent a draught, though it slightly modifies it." This is hardly correct; it is the peculiar property of this contrivance to admit of being adapted to the particular circumstances of the atmosphere with the greatest facility and precision. The openings between the louvres may be adjusted so as to present an opening of from one-tenth of an inch upwards to the extent of two inches or more, by merely touching a cord acting on a pulley which turns a spiral movement. When slightly open (in which state they may have been thought closed) they divide the entering current of air into thin strata, the force of which is completely broken, and directed upwards. When the requirements of the apartment call for a larger supply of air the openings can be increased at pleasure to the extent stated. I would observe that there can be no *ventilation* without *circulation*, and Fair's ventilator surpasses all other contrivances in the extent to which it favours circulation. In the ordinary hopper, as also in Dr. Guy's perforated plate (through the interposition of the shield) the entrance or exit of air takes place through a single opening on one particular level. In the glass louvres there is a series of openings one above the other, in consequence of which, a perfect circulation obtains; the vitiated heated air escaping through two or more of the uppermost apertures, while fresh air enters through those beneath.

The perforated ventilator has a decided preference in point of cheapness, but is open to some objections; the obstruction of light will in some cases be a great disadvantage, while the perforations will require to be very often cleaned from the particles of dust, which will collect within the holes with great rapidity. This has proved a source of great annoyance when fine wire-gauze has heretofore been used for a similar purpose, and which, by the bye, is in some respects superior to the perforated plate, stopping less light, and so effectually breaking up the current of air as not to require any shield on the inside.

Wherever an elegant, easily adjustible, and efficient ventilator is required, the *glass louvres* will always be preferred; while Dr. Guy's arrangement affords the means of introducing ventilation to places not hitherto provided with that health-preserving principle.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington,
December, 1844.

Note.

We cannot say that our preference of Dr. Guy's invention is at all shaken by our correspondent's observations. The objections to Fair's ventilator, in addition to its costliness, are, that when it is so little open as to distribute the air by dividing it into thin strata, it does not admit air enough,—that when more widely opened the air enters in a body, occasioning a strong draught,—and that it does not exclude the particles of soot and dust floating in the atmosphere of large towns. The alleged circulation of air we must take leave to doubt, till we see it experimentally proved. In all rooms supplied with chimneys, the exit of foul air is by the chimney, and the entrance for fresh air through all the openings in the room, wherever they may happen to be. The obstruction of light in Dr. Guy's arrangement is so slight, when the shield is of glass, that it can form no objection even to the most fastidious. The necessity of cleaning the zink plates points to one great advantage of this invention—namely, that it arrests

the soot and dust of large towns. The fine wire-gauze will not do; for if fine enough to prevent a draught it admits little air, and gets clogged in one or two days. The zink plates, which, after some experience Dr. Guy recommends, are perforated with large apertures, which scarcely obstruct the light, and yet arrest the grosser particles floating in the air. The grand advantage of Dr. Guy's ventilator, especially the circular form of it, is, that it entirely prevents a draught, so that it can be open at all times and in all weathers, without inconvenience, giving a constant supply of air, varying of course with the strength of the chimney-draughts and the force of the wind, but, even when these are at their highest, creating not the slightest draught. All oblique arrangements cause the air to be thrown into the room, whence it descends as a full stream or shower on the heads of the inmates. By Dr. Guy's arrangement (we speak now of the circular form) it is spread over the wall or window by which it enters, as a layer of air, strictly limited to the plane of the shield. It is a very great advantage that a ventilator can safely be left open at all times. We ought always to have a free supply of air entering our rooms. Though we by no means wish to speak disrespectfully of the glass louvres, we should be very sorry to occupy a room in which they were always open, even to the tenth of an inch.—Ed. M. M.

DR. GUY'S SYSTEM OF VENTILATION.

Sir,—Having read with attention in your valuable Magazine, No. 1113, page 386, your observations on ventilation, together with Dr. Guy's patent for the same, I beg to call your attention to what appear to me to be reasonable objections to the above-named gentleman's plan. At the same time, I wish to be understood that I am in favour of it as an improved ventilator of the present day.

In the first place, when a strong wind is directed against it, it will make a disagreeable noise. Second, when heavy rain is driven against it, a stream of water will run down inside the window. Third, it tends to obstruct the light. Fourth, there is no provision made in it to moderate its action in high windy weather.

I have for a length of time carefully studied the best plans for ventilation for all kinds of dwellings, and I hope I may not be thought presumptuous when I say that I have discovered a plan which cannot be objected to for its cost, simplicity, or efficacy, by the poor or rich, for it is equally suitable to the palace as it is to the humblest dwellings.

It overcomes all the objections I make to Dr. Guy's plan, and my only reason for not now publishing an account of my invention is, that I intend patenting it sooner or later, when I trust it will be encouraged and appreciated by all classes of the community.

By finding me a corner for this in your valuable work, you will much oblige

Your humble and obedient servant,

Vincent Price.

33, Wardour-street, Oxford-street,
December 18, 1844.

[Mr. Price is wrong about the noise; there is no sort of noise, even in the highest wind, with Dr. Guy's apparatus. It is not intended to moderate its action in high winds, as there is no inconvenience from a more free admission of air at such times. Besides, it is stated in Dr. Guy's specification, that, if necessary, the ventilators may have *valves*. The objection, that water will enter, is of little moment. With some forms of the apparatus, arrangements can easily be made for carrying it off, and it will collect and evaporate from the others. In any case the quantity will be very small. When the shield is of glass it obstructs very little light. The prevention of draught overrules all the other trifling objections to which the new invention is open. See Note on preceding communication.—Ed. M. M.]

ON THE CONSTRUCTION AND PROPER PROPORTIONS OF BOILERS FOR THE GENERATION OF STEAM. BY ANDREW MURRAY, ESQ., C.E.

[From Minutes of Proceedings of the Institution of Civil Engineers, June 18, 1844.]

This paper commences by investigating the quantity of air chemically required for the perfect combustion of a given quantity

of coal, of the quality commonly used for steam purposes. The amount of air to each pound of coal is stated to be 150·35 cubic feet, of which 44·64 cubic feet are required for the various carburetted hydrogen gases given off, and 105·71 for the solid carbon. The practical utility, however, of this knowledge is much impaired by the circumstance that combustion ceases even in pure oxygen, and much more in air, before the whole of the oxygen present has entered into the new chemical combinations required. It is also known that carbonic acid gas exerts a positive influence in checking combustion, as a candle will not burn in a mixture composed of four measures of air and one measure of carbonic acid gas. Large quantities of this gas being generated by the combustion of the solid carbon on the grate, and being necessarily mechanically mixed with the inflammable gases as they rise, the quantity of air required for their subsequent combustion must, on this account, be increased to a very large extent. The whole of the air thus supplied in excess must be heated to a very high temperature before any combustion can take place, and the loss of the heat thus absorbed must be taken into account in calculating the ultimate economy of igniting these gases.

The form of furnace now in general use, in which the fuel is spread over a large surface of fire-bar, has not been subject, in so far as affects the supply of air through the bars, to much alteration, amongst the many patents and proposals which have been made for the more complete combustion of coal. The point most open to change in the common furnace is the width between the bars; and as it is desirable to have the supply of air to the furnace as abundant as possible, it should be made as large as can be done without causing waste by allowing the coal to fall through into the ash-pit. A greater number of these bars is thus to be preferred to a smaller number of broad or thick bars; indeed, to such an extent is this carried in France, where coal is more valuable than in this country, and the chemistry of the subject perhaps more generally understood, that the bars are made not more than half an inch thick, the necessary strength being obtained by making them 4 inches deep. With coke or wood, which cannot fall through the bars and be wasted, in the same way as coal, the space is always made much wider, and with great advantage; so much so with coke, as to have led to the opinion that a given quantity of coke would produce as much heat by its combustion as the coal from which it was made. Any grounds for such an opinion could only have arisen from the combustion of the coal having been so imperfect, that not only had the whole of the gases passed off unconsumed, but even a large portion of the solid carbon must have been allowed to escape in the form of carbonic oxide, without having generated its due amount of heat, and been converted into carbonic acid gas.

In the combustion of coke, or of the solid portion of coal, as left in an incandescent state on the fire-bars of a common furnace, after the volatile gases have passed off, the amount of heat generated by the whole of the carbon, uniting at once with its full amount of oxygen, will be the same as what would be generated by its combination, first, with a smaller quantity of oxygen, forming carbonic oxide; and subsequently, by the ignition of this gas, by its combination with the further quantity of oxygen required to turn it into carbonic acid gas.

As some portion of the carbon is always converted into carbonic acid gas in the furnace, it follows, that the air for the ignition of any carbonic oxide there formed, and allowed to pass into the flues, must be greatly in excess of the quantity chemically required; and the whole of this excess must be raised to the temperature of the other gases with which it will be mingled. The superior economy, therefore, of at once converting the whole of the carbon into carbonic acid gas is apparent; and there is no doubt but that this very desirable result may be obtained nearly to the full extent, by due care in the formation and subsequent management of the furnace.

The best mode of supplying air to the other inflammable gases resulting from the combustion of bituminous coal, which are composed of hydrogen and carbon, and which will be treated of under the common name of carburetted hydrogen, has been a matter of much controversy, and been the subject of many patents. The mode proposed by the greater number of the patentees is, to admit the air immediately behind the furnace, at the back of what is termed the bridge. A bridge does not exist in every case; but where it does exist it is generally in the form of a wall or obstruction, right across the back of the furnace, often placed there for no other purpose than to prevent the fire from being pushed back into the flue. The whole of the products of combustion, as formed in the furnace, necessarily pass over this bridge, before entering the flue. The additional air is sometimes heated previously to its being admitted to the gases, after they have left the furnace, and the manner in which it is supplied, varies exceedingly; one party advocating its admission in a long thin film; another through a great number of small orifices, and others again attach less importance to the manner

of its admission, so that it is only admitted in sufficient quantity. All these plans proceed upon the supposition that large quantities of inflammable gas pass off from the furnace, and as none of them directly affect the operations going on within the furnace itself, the gases which are actually given off would be the same until they pass over the bridge, whichever plan might be adopted.

These plans must all cease to be necessary or useful if a furnace can be so constructed, and the combustion of the coal in it so managed, that a very small proportion only of uncombined inflammable gases would pass off, as in this case no economy would result from their combustion, owing to the large excess of air which must be supplied and heated as before explained.

The admission of a large quantity of air into the flue, at a distance from the furnace, though advocated by some authorities, cannot be advantageous, unless in extreme cases, when the temperature in the flue is very high, and where the combustion in the furnace has been more than usually imperfect.

As the carburetted hydrogen gases are generated rapidly on the application of heat to the coal, and are in themselves much lighter than the carbonic acid gas, or the nitrogen gas formed at the same time, it is sometimes assumed that they rise nearly unmixed to the top of the space over the furnace, and thence it is considered more advantageous to supply the air at this place than in the flue. The cooling effect of air, if admitted into the furnace, has been stated to be more injurious than if admitted into the flue; but the correctness of this statement may be doubted, especially if the gases be unmixed, as this would render a much less quantity of air sufficient.

The bars in this case should be placed at least 2½ feet or 3 feet below the boiler, or the crown of the furnace, to allow the principle to be more fully carried out. An increase of space over the bars to this extent has always been found to be advantageous, and ought to be particularly attended to. The system of admitting the air to the gases, in a subdivided form, in whatever part of the boiler the admission of it may take place, is very efficacious in procuring a thorough and speedy mixture of the particles. It has been very extensively and successfully introduced by Mr. C. W. Williams* in supplying air behind the bridge of the furnace.

An opinion is entertained that a sufficient supply of air for the gases may be obtained, through the fire-bars; and it is obvious, that a partial supply at least, may be obtained in this manner, by a judicious management of the fire. This may be effected by keeping the fires thin and open, feeding by small quantities at a time, or by a system of coking the coal, allowing the combustion of it to be slow at first, by which means the coal is formed into masses of coke, between which the air has a passage. The air which passes through, is not vitiated further than in being mechanically mixed with the carbonic acid and nitrogen gases, caused by the combustion of the coal on the bars.

The perfect combustion of the whole ingredients of coal being entirely dependent, chemically considered, on the supply of the due quantity of atmospheric air, it is evident that the velocity with which the air flows into the fire, will materially affect the result. According as this velocity is greater or less, so in proportion must the quantity of coal that is to be consumed on a given area of grate, be increased or diminished, and there is no limit to the quantity that may be so consumed, beyond the difficulty of supplying the air with sufficient rapidity. The various circumstances which affect the velocity of the entering air, have placed this question, as yet, completely beyond the reach of theory, so that practical experiments must be taken as the only guide, in determining what quantity of air can be made to enter into a given furnace, and consequently, what amount of coal can be properly consumed in it, in a given time.

Mr. Parkes has stated, as the result of a long series of experiments made by him,* that the rate of combustion should not exceed 7 lbs. per superficial foot of grate bar per hour, and that this quantity may with advantage be reduced as low as 4 lbs. or even 3 lbs. General experience would tend to prove, that these latter quantities are unnecessarily low, and can only be advantageous, when the arrangements for supplying the air, or for carrying off the products of combustion, are defective or inefficient. It is evident, that if the area of any part of the passage, for either of these currents, is too limited, the velocity at this contracted spot cannot rise higher than is due to the weight of the ascending column of heated gases in the chimney. The quantity passing through, is therefore diminished in proportion as the area is limited; and a good draught at a particular place, as at the bridge of a boiler, may here be quite compatible with an insufficient supply of air, and imperfect combustion of the coal. The draught in every other part of the flues is, at the same time, rendered slow and languid, and deposition of soot takes place in them.

* Vide "On the Combustion of Coal, &c.," by C. W. Williams. 8vo. London, 1841.

* Vide 'Trans. Inst. C. E.,' vol. iii.

This fault is apparent in a great number of boilers at present in use, and in some cases, especially in tubular boilers, it is attended with very injurious results, by stopping up the tubes and decreasing the amount of heating surface to such an extent, as to render the boilers incapable of generating the required amount of steam.

The furnaces of the boilers in general use in Cornwall, are upon the common principle of construction, and as in them it is not usual to apply any of the peculiar patented arrangements, for the supply of air to the gases, behind the bridge, it follows, either that these gases are not consumed, or that they are consumed by air admitted through the bars. In the Cornish system of raising steam, slow combustion is adopted in its fullest extent; the fires are kept thin and open, the fuel is supplied in small quantities and frequently, and it is well spread over the whole surface. As the result is highly favourable in the economy of fuel, it may be presumed that the combustion of the gases, as well as of the solid carbon, is comparatively perfect. When more air is admitted into the furnace than can be made to enter through the bars, it is generally done by apertures in the furnace doors.

The average rate of combustion throughout the country, is far above even the largest quantity named by Mr. Parkes, and may be stated to be about 13 lbs. per superficial foot of grate per hour. With due care in the construction of the furnaces and flues, there seems to be no reason why this quantity may not be as perfectly consumed, and the heat as thoroughly extracted from the products of combustion, before they leave the boiler, as with the smaller quantity. Whether this be so or not, it is necessary in practice to prepare for many cases, as on board of steam-vessels, where it is impossible to allow a larger amount of fire grate, or boiler room, and when it would cease to be ultimately economical to obtain a small saving of fuel, by great additional expense in boilers and their fittings, and in space for them.

To determine the velocity with which the products of combustion pass off from the furnace, or from the boiler, is attended with much difficulty, on account of the great number of extraneous circumstances, which do so easily and so constantly affect it. Some experiments on this subject were made by Dr. Ure, and an account of them was read before the Royal Society,* when he stated, that he considered the velocity might be taken, at about 36 feet per second, and as this result has been corroborated by others, it may be assumed, in the absence of better data, as nearly correct.

The subject, in a theoretical point of view, is surrounded by many difficulties—in discovering the allowance which must be made for friction, and other circumstances, similar to those affecting the flow of water through pipes; and though this latter has engaged much more of the attention of scientific men, no very definite results, to bear accurately upon practice, can yet, even in this case, be obtained by calculation.

The practical question of the proper proportions of the different parts of boilers, is then proceeded with in the paper, the leading chemical and physical features, connected with the combustion of coal in their furnaces, having been considered.

The supply of the requisite quantity of air to the fuel on the bars, being of the utmost importance, it is usual to make the ash-pit, and the entrance to it, as large, and as free, as the situation will allow. In marine boilers, or wherever it is necessary to limit the size of the ash-pit, the area for the entrance of the air into it, should never be less than one-fourth part of the area of the grate; and in order to facilitate the supply to the back part of the grate, the bars should be made to incline downwards to the extent of about one inch in a foot. No advantageous results will be obtained from increasing the ash-pit, as is sometimes done in land boilers, to a very great extent, by making it 5 or 6 feet deep; about 2½ feet is sufficiently deep, even supposing that the ashes are not cleared out oftener than once a day.

The extent of 'dead plate' in front of the furnace is not material, as respects combustion; in marine boilers, it is generally not more than about 6 inches broad, which is the width of the water space, between the fire and the front of the boiler; but in land boilers it is frequently required to be very broad, to support the brick-work, especially in those cases where the flue is carried across the front.

The amount of the opening between the bars, should be about $\frac{7}{16}$ths of an inch, but this must be regulated by the kind of coal to be burnt upon them; but for any kind of coal, it should not be less than $\frac{3}{8}$ths of an inch, nor more than ½ an inch. If the space were made larger, the waste from the amount of cinders, or of small pieces of coke, which would fall through in a state of incandescence, would be considerable; otherwise it would be preferable to have a larger space. In order to facilitate the supply of air, each bar should be as thin as is consistent with the strength required. The bars in general use in this country, are 1 inch or 1¼ inch in thickness, but it would be much

* Read June 16, 1836.

more advantageous to use them thinner, as in France, where they are frequently used not more than ¼ inch thick.

The advantage of a considerable amount of space in the furnace, over the fire-bars, has been already mentioned, but no very decisive experiments have been made on this subject. Three cubic feet of space to each superficial foot of grate bar surface, may be stated as a good proportion, where there is nothing to prevent this amount being obtained. When the space is reduced below one foot and a half of grate, it will be found to be attended with a marked disadvantage.

The area of the flue, and subsequently of the chimney, through which the products of combustion must pass off, must be regulated by their bulk and their velocity. The quantity of air chemically required for the combustion of 1 lb. of coal, has been shown to be 150·35 cubic feet, of which 44·64 enter into combination with the gases, and 105·71 with the solid portion of the coal. From the chemical changes which take place in the combination of the hydrogen with oxygen, the bulk of the products is found to be to the bulk of the atmospheric air required to furnish the oxygen, as 10 is to 11. The amount is therefore 49·104. This is without taking into account the augmentation of the bulk, due to the increase of the temperature. In the combination which takes place between the carbon and the oxygen, the resultant gases (carbonic acid gas and nitrogen gas) are of exactly the same bulk as the amount of air, that is, 105·71 cubic feet, exclusive, as before, of the augmentation of bulk from the increase of temperature. The total amount of the products of combustion in a cool state would therefore be

$$49{\cdot}104 + 105{\cdot}71 = 154{\cdot}814 \text{ cubic feet.}$$

The general temperature of a furnace has not been very satisfactorily ascertained, but it may be stated at about 1000° Fahrenheit, and at this temperature, the products of combustion would be increased according to the laws of the expansion of aëriform bodies, to about three times their original bulk. The bulk, therefore, of the products of combustion which must pass off, must be $154{\cdot}814 \times 3 = 464{\cdot}442$ cubic feet. At a velocity of 36 feet per second, the area, to allow this quantity to pass off in an hour, is ·516 square inch. In a furnace in which 13 lbs. of coal are burnt on a square foot of grate per hour, the area to every foot of grate would be $\cdot516 \times 13 = 6{\cdot}708$ square inches; and the proportion to each foot of grate, if the rate of combustion be higher or lower than 13 lbs., may be found in the same way.

This area having been obtained on the supposition that no more air is admitted than the quantity chemically required, and that the combustion is complete and perfect in the furnace, it is evident that this area must be much increased in practice, where we know these conditions are not fulfilled, but that a large surplus quantity of air is always admitted. A limit is thus found for the area over the bridge, or the area of the flue immediately behind the furnace, below which it must not be decreased, or the due quantity could not pass off, and consequently the due quantity of air could not enter, and the combustion would be proportionally imperfect. It will be found advantageous in practice, to make the area 2 square inches instead of ·516 square inch. The imperfection of the combustion in any furnace, when it is less than 1·5 square inch will be rendered very apparent, by the quantity of carbon which will rise unconsumed along with the hydrogen gas and show itself in a dense black smoke on issuing from the chimney. This would give 26 square inches of area over the bridge, to every square foot of grate, in a furnace in which the rate of combustion is 13 lbs. of coal on each square foot per hour, and so in proportion for any other rate. Taking this area as the proportion for the products of combustion, immediately on their leaving the furnace, it may be gradually reduced, as it approaches the chimney, on account of the reduction in the temperature and consequently in the bulk of the gases. Care must however be taken, that the flues are nowhere so contracted, nor so constructed, as to cause, by awkward bends or in any other way, any obstruction to the draught, otherwise similar bad consequences will ensue.

An idea is very prevalent, that it is advantageous to make the flame, or hot gases (as they may be termed, because we may look upon flame merely as a stream of gases heated to incandescence) impinge upon, or strike forcibly the plates of a boiler, at any bend or change of direction in the flue. The turn in the flue is therefore made with a square end, and with square corners; but it is difficult to see on what rational grounds the idea of advantage can be upheld. The gases, if they are already in contact with the plate, cannot be brought closer to it, and any such violent action is not necessary to alter the arrangement of the particles of the gases and bring the hotter particles to the outside, while there is great risk of an eddy being formed and of the gases being thrown back and returned upon themselves, when they strike the flat opposing surface; thus impeding the draught and injuring the performance of the boiler. That circulation will take place to a very great extent, among the particles of heated gases, flowing in a stream even in a straight flue, will be appar-

ent, from those particles next the surface being retarded by the friction against the sides and by their tendency to sink into a lower position in the stream, from their having been cooled down and become more dense. An easy curve is sufficient to cause great change in the arrangement of the particles, as those which are towards the outside of the bend have a much longer course to travel and are thus retarded in comparison with the others. From these causes the hotter particles in the centre of the flowing mass, are in their turn brought to the outer surface and made to give out their heat. The worm of a still is never found returning upon itself with square turns, as if the vapour inside would be more rapidly cooled by impinging on the opposite surface; yet the best form of worm is a subject which has engaged the attention of many able men, and therefore may well be taken by engineers as a guide in the management of a similar process, though carried on at a much higher temperature.

Another very prevalent practice, and which also would seem to be open to serious objections, is, that the flues are frequently made of much greater area in one part than in another. This arises from a desire to obtain a larger amount of heating surface than is consistent with the proper area of the flue, or with the amount of the heated gases which are passing through it. The flue is thus made shorter in its course than it ought to be in proportion to its sectional area. This is even sometimes done by placing a plate of iron partly across the flue, near the bottom of the chimney, thus suddenly contracting the passage for the gases. The effect of this is evidently to cause a very slow and languid current in the larger part of the flue, and the consequence is that a deposition of soot rapidly takes place there. In many marine and land boilers, having one internal flue in them, of too large a size, this will be found to be the case; soot being soon deposited, till the flue is so filled up, that the area left is only such as is due to the quantity of heated gases passing through it; the value of those parts of the sides of the flue which are covered with soot is thus lost.

This is well exemplified in Mr. Dinnen's paper on marine boilers, in the Appendix to Weale's edition of Tredgold, where he states that the flues of the boiler in H. M. Steamer *African*, after she had performed a great deal of work, in the course of five weeks' time, during which period there was no opportunity of sweeping them, were found to be in exactly the same state as after a voyage of only five days, or probably as they would have been found after a much shorter time, if they had been examined. These flues are about the same area throughout their whole length, but the chimney is of much less area. In the first portion of the flue from the fire no soot was deposited, but the deposit began after the first turn that the flue took, and gradually increased in amount to the foot of the chimney. The inference that may be drawn from this fact appears to be, that the gases, at first highly heated, and thereby expanded, filled the first part of the flue; but as they were cooled, they became more contracted in their bulk regularly towards the chimney, and therefore allowed the soot to be deposited in the space not properly filled by them in their course; and all soot subsequently formed was carried out at the chimney top, by the velocity and power of the current. The amount collected near the foot of the chimney, and in the portions of the flue furthest from the fire, diminished the amount of the surface of the boiler exposed to the action of the heated gases, and the efficiency of the boiler was therefore impaired to the same extent. In those boilers in which the flues, before reaching the chimney, are very much too large, and are contracted, as has been stated, by a plate put across them, the extent to which their efficiency is thus impaired must evidently be much greater, and to a serious extent, as this evil exists in them in a very much greater degree.

The due amount of heating surface that ought to be given in a flue, to carry off the caloric, or to cool down a given quantity of heated gases, has not yet been investigated with any great degree of accuracy; and practice varies widely under different circumstances. The largest proportion is allowed in the Cornish boilers, some of which have not less than 30 feet, and even 40 feet, of heating surface to one foot of grate. This appears to be more than is justified by any corresponding gain, and certainly more than would be advisable in any marine or locomotive boilers. In boilers burning 13 lbs. of coal per hour on each superficial foot of grate, a proportion of 18 feet to each foot of grate will be found to give good results. Where slow combustion is carried on, and where an extra size of boiler is not objectionable, some advantage may be gained by increasing the amount in proportion to the amount of fuel consumed. In calculating this surface, it is usual not to include the bottoms of the square flues in marine boilers, and in circular flues from ¼th to ⅓rd of the surface should be deducted as bottom surface, and therefore not efficient as heating surface. It is not usual to make any distinction between horizontal and vertical surfaces, though it is probable that the former are considerably more valuable. The

efficiency, however, of some boilers which have been made with vertical tubes, would rather tend to make it doubtful whether so much difference exists between the value of horizontal and vertical surfaces as has been generally supposed.

If the area, instead of being in one large flue, be subdivided into a number of small flues, or pipes, so as to expose the gases to the required amount of surface in a short course, the distance traversed between the fire-place and the chimney does not seem to be important. The velocity of the current of gases will not be materially influenced by their subdivision, as the whole amount of the surface with which the gases must come in contact tending to impede their course by friction, will be the same in both cases. It is evident that numerous small flues, by subdividing the large stream of gases, which in the other case flow off in one body, bring the greater proportion of the particles at once into contact with the surfaces, and therefore render it unnecessary to pay the same amount of attention to the turning of the stream and the bringing out the hotter particles from the centre of the flowing mass. If these proportions of area through the flues and of heating surface, be duly attended to, the results anticipated may be depended upon, whether flues are of large area, or are composed of a large number of smaller tubes.

The time occupied by the gases in passing through the boiler, from the instant of their generation, to that of their leaving the boiler, and the length of the course through which they have travelled, have sometimes been looked upon as matters of great importance. Where the gases are travelling in one compact mass, it is evident that distance and consequently time (as the velocity with which the current flows is the same in all cases) must be allowed, for the different particles of this large mass, so to circulate among themselves, as that each may have an opportunity of coming into contact with a cooling medium, to give off its heat; but if the large mass of gases is so subdivided, that the different particles are sooner brought into contact with the due amount of cooling medium, then the time the gases remain in the boiler ceases to be of importance.

When the gases have reached the foot of the chimney, in a well-proportioned boiler, they will be found to be reduced to a temperature of about 500° Fahrenheit, or below it; their bulk will, in consequence, be reduced by about ⅓rd below their bulk on their first leaving the furnace. The reduction in the area of the flue, ought not to be in the same proportion, because their velocity is no longer so great. The reduction ought to be made gradually, as has been stated before, and not by a sudden contraction at the foot of the chimney, as the effect of this is to cause a slowness of draught in the latter part of the flue and consequently a deposition of soot; and then the surface, so covered, which had been reckoned upon as effective heating surface, is lost. The area of a chimney, to allow the products of the combustion of each pound of coal consumed in an hour, to pass off, should be not less than ¾ths of 2 square inches, this latter being the area given for the flue, immediately behind the fire-place—that is, 1½ square inch; and for a boiler burning 13 lbs. of coal per hour, on each superficial foot of its grate, the area should be ¾ths of 26 square inches, or 19½ square inches.

Theoretical research not having as yet given us any valuable assistance, in determining the proper height of a chimney, we must again refer to practice as our guide. A good draught may be obtained with a very low chimney, but at a great expenditure of fuel, from the necessity that exists in such a case for allowing the gases to pass off at a much higher temperature than would otherwise be necessary. For a chimney built of brickwork, the height ought not to be less than 20 yards, and may be increased to 30 yards or 40 yards, with advantage in the economy of fuel. When chimneys are carried to a still greater height, it is generally for the purpose of carrying off the smoke, or any deleterious gases from the immediate neighbourhood, or to create a good draught with gases at a lower temperature, than those from a steam-boiler furnace. On board steam vessels, chimneys are limited in their height by the size of the ship, on account of the influence the chimney has on the stability and appearance. It will generally be found advantageous to make the chimney as high as these circumstances will permit.

It will be found to tend greatly to the efficiency of a boiler, to allow a large space in it as a reservoir for steam. The surface for ebullition does not seem to be of much importance, in comparison with this point.

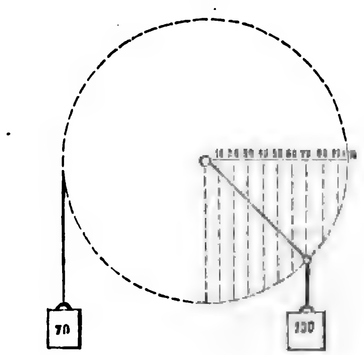
In the application of the foregoing proportions to practice, no reference need be had to the form of the boiler; the same results will be obtained, whether the boiler be circular, wagon-shaped, or any other form, if all the other circumstances be made the same.

By due management in the process of firing, when these proportions are given to the furnaces and flues, the combustion will be found to be such, that but little carbon will pass off to be converted into smoke, and the results will show great economy in the consumption of fuel.

THE POWER COMMUNICATED BY THE CONNECTING-ROD TO A CRANK.

Sir,—The best and clearest way to point out the erroneous calculations your correspondent "B. B." has made in his letter, inserted in your excellent Magazine for Nov. 30th, relative to the crank, is to state my views of how a table should be *correctly* made out, showing the pressure transmitted *in a circular direction* by a crank, compared with the pressure exerted by a connecting-rod against it during a stroke.

In calculating the comparative pressure transmitted by a crank in a circular direction, we have nothing whatever to do with the crank circle (so far as dividing it into a number of parts is concerned), simply because of the fact that the *crank end* of a connecting-rod always travels *at the same speed* as the crank pin. We have merely to draw a horizontal line from the crank centre to the crank circle, and intersect that *horizontal* line with ten perpendicular lines, at an equal distance apart, as in the following diagram.



Experiments actually *performed* will corroborate what I am now going to say. When a crank pin is immediately beneath any one of those perpendicular lines, the figures above that line will express the per centage of connecting-rod pressure then being transmitted by the crank in a circular direction. For example, when a crank pin is in the position shown in the diagram, 70 per cent. of the connecting-rod pressure *then* tends to turn the crank; the remaining 30 per cent., instead of tending to turn the crank, is transmitted towards the centre of the crank, and is finally expended in forcing the crank shaft against its bearings. Now this 30 per cent. having no tendency to turn the crank is, of course, *lost*. It will be seen from the diagram, that, upon an average, only 50 per cent. of the connecting-rod pressure is given out by the crank in a circular direction.

We are all well aware that the *crank end* of a connecting-rod and its crank pin must at all times travel at an *equal velocity, and together;* and we are likewise well aware that the *crank end* of a connecting-rod travels at one-third greater average speed than its piston during a stroke; therefore, it must be beyond dispute, that if there is a steam pressure of 100 lbs. upon a piston during a stroke, the average pressure exerted against a crank pin by an infinitely long connecting-rod must be 63 lbs. Now we have already seen that the average pressure transmitted by a crank in a circular direction throughout a stroke is *half* the connecting-rod pressure, so that the average pressure given out *by the crank* in the direction of its orbit, during a stroke, will be 31½ lbs. Let it be recollected that the crank gives out a constant pressure during a stroke of 31½ lbs. in a circular direction, and that the piston, during the same stroke, has a constant steam pressure of 100 lbs. exerted against it; I need scarcely remind your readers, that for every 1 foot travelled through by a piston, the crank, at an average, travels through 1·575 feet in the same instant of time; they will readily see that 31½ lbs., given out through 1·575 feet, is equal to 50 lbs. given out through 1 foot. Is it not very clear, then, that as the crank only transmits a 50 lbs. pressure in a circular direction through 1 foot, while a 100 lbs. pressure is raising the piston 1 foot—I ask, is it not very clear that half the pressure upon the piston is wasted by the crank? I cannot suppose any of your readers so dull as to think otherwise.

I have often, Mr. Editor, been highly amused with crank advocates, when discussing the crank. Show them experiments illustrative of the crank motion, and they will own they do appear to prove a considerable loss to ensue by the use of the crank; describe to them the theory of its action, and they will acknowledge they cannot dispute the apparent correctness of your theory; ask them for their experiments showing that

no loss ensues by the crank, and they will tell you that no experiment will illustrate the average pressure given out by the crank in a circular direction; and, lastly, ask them for their theory, and they will bring forth a diagram showing a semicircle divided into a number of parts, from which they make a table, showing the comparative *speed* of the piston and crank, and call it a table showing their comparative *pressure*. What wonder, then, that they cannot produce experiments in favour of the crank, when they make such blundering calculations respecting it.

I wish it perfectly understood by all your readers, that although I condemn the crank when the power transmitted against it is through the medium of a connecting-rod, yet, when worked by the hand, I consider it a perfect circular transmitter of power; because the hand gives out a pressure against it in a circular direction, and the natural direction of the crank being circular, gives out the pressure of the hand in that direction *without any loss*.

The crank, when turned by the hand, is not only a perfect circular transmitter of power, but it has peculiarly valuable properties *under certain circumstances*.

In the case of drawing up a bucket of water from a well, should the bucket of water, &c., when near the surface of the well, weigh 100 lbs., it will offer that amount of resistance to the movement of the hand when turning the winch, because the rope (which we will suppose is coiled round a drum of the same diameter as the crank circle) always hangs *at a tangent* with the crank circle; but when a 100 lbs. weight is hung upon a crank pin, the average resistance offered by that weight to the hand, while turning the crank through a semicircle, will be only 50 lbs., because at that point its whole weight is resting upon the crank, and offers no resistance whatever to the circular movement of the hand; but by turning the crank, the resistance of the weight will be gradually increased until it arrives in a horizontal position, and then it offers a momentary resistance of its full force of 100 lbs. to the hand: its average resistance to the hand will, of course, be half its gravity. It must always be kept in mind that weight and hand would pass through precisely the *same* amount of space, while describing the semircircle.

We thus see that the crank has the valuable property of preventing the weight offering a greater resistance to the circular movement of the hand than half its gravitating force.

If an infinitely long connecting rod be attached to the pin of the crank, and a weight of 100 lbs. attached to the other end of the connecting-rod, and the weight capable of sliding between two upright guides, the average resistance that weight will offer, throughout a semicircle, to the circular movement of the hand, will be about 31¼ lbs.; this manual pressure, through a semicircle, is equal to a 50 lbs. pressure through the space passed through by the weight of 100 lbs. This peculiar property of the crank renders it a most desirable movement in all hand engines.

The reason why this property of the crank is so little known, is probably because, in hand-worked crank engines, short connecting-rods are used. These, by absorbing a great deal of force, owing to their oblique action, reduce the power of a crank hand-worked engine to the level of a reciprocating engine.

I am, Sir,
Your most obedient servant,
N.

LOWE'S SCREW-PROPELLER.

Sir,—Referring to your historical notices of screw-propellers, in the October Number of your Magazine, 1843, I have to draw your attention to an omission of the name of the only one that is destined to be generally adopted, —the patent of Mr. James Lowe, dated 24th March, 1838, which consists of "curved blades, each a portion of a curve, which, if continued, would produce a screw." These sections of a screw are now generally in use, as the recent trial in the Court of Queen's Bench, on Monday last, against Mr. John Penn, of Greenwich, fully testifies. As you have unintentionally omitted to class Mr. Lowe's patent among your notices of patents, you will doubtless do him the justice of now calling the attention of the readers of your valuable miscellany to the important subject by giving insertion to this communication, or by noticing the result of the trial in some other way.

Your strict impartiality as a public journalist gives me full confidence in your

compliance, which will vindicate the truth, so long attempted to be stifled by a combination of interested parties.

I enclose a copy of Lowe's specification; the drawing you have already published in your 31st vol., p. 49.

I am, Sir,
Yours respectfully
T. EYRE WYCHE,
Plaintiff's Solicitor.

13, George-street, Mansion House,
December 20, 1844.

Mr. Lowe's Specification.

To all to whom these presents shall come. I, James Lowe, of King-street, Old Kent-road, in the county of Surrey, mechanic, send greeting. Whereas, &c. Now know ye, That in compliance with the said proviso, I, the said James Lowe, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are fully described, and ascertained in and by the following statement thereof, reference being had to the drawing hereto annexed, and to the figures and letters marked thereon; (that is to say,) my invention consists in a mode of propelling vessels by means of one or more curved blades, set or fixed on a revolving shaft, below the water line of the vessel; and running from stem to stern of the vessel.

Description of the Drawings.

Fig. 1 represents so much of the stern of a vessel having my apparatus applied thereto for propelling, as will enable me to explain the nature of my invention; *a* being the shaft or axis on which the curved blades are set or affixed. The shaft or axis is to receive rotary motion from a steam-engine, or other suitable power. *b b* are four curved blades, each a portion of a curve which, if continued, will produce a screw; but here I would remark that screws have been heretofore attempted to be used, and have failed of success, which has been owing to the water not being able to pass away; but that may be said to produce a choking action, and my invention is such, that there being only sections or portions of a screw employed, each blade is a propelling instrument which allows the water to pass away in all directions, except at that point where the instrument is in full action; hence, there is no choking or holding the water towards the centre of motion, which is the case in using complete screws.

Fig. 2 shows a portion of the shaft or axis, having only one blade or section of a screw; and

Fig. 3 shows an arrangement of two blades, one placed in the same line as the other. I should state that, although this is an important improvement over the use of a complete screw, yet, so far as my experience has gone, I have not found such an arrangement so good as the using each section of a screw or blade out of the line of all other blades, as is shown in fig. 1.

The blades, it will be seen, are at the stern of the vessel, and the shaft on a line parallel with the keel; and the shaft, in passing through the vessel below the water lines is through a stuffing-box, in order to render the same water-tight.

It should be stated that, although I prefer to have the shaft above the keel, and in a parallel line with it, and the propellers at the stern of the vessel, I do not confine myself thereto, as a shaft or shafts below the water line, having similar propellers, may be used at other parts of the vessel, such as at the sides, or at the dead wood; but I believe that such arrangements are not so convenient as those shown by the drawing; and it should be stated that I am aware that propellers having somewhat similar action were some years ago experimented upon, and for which invention a patent was taken by Edward Shorter, such propellers being carried by certain outriggers over the bow of the vessel, as is shown and described in the specification of his patent; but the same failed.

I do not, therefore, claim the application of curved blades generally; but my invention relates to the *modes herein described of propelling vessels, by applying one or more curved blades on shafts or axes, below* the water line of such vessels.

In witness whereof, I, the said James Lowe, have hereunto set my hand and seal, this twenty-fourth day of September, in the year of our Lord, 1838.

SCREW EXPERIMENTS WITH THE "PIGMY GIANT."

Sir,—In forwarding you the summary of experiments with the screw-boat, my intention was to lay before your readers *data* on which to form a correct opinion of the effective power produced by roller rotary engines.

In doing so, I adhered closely to Mr. Joshua Taylor Beale's manuscript in my possession, and in that manuscript, of which he has the counterpart, occurs the passage quoted by him in his last communication, being his own description of his boat, which he now unwittingly admits to be "vague." Mr. Beale has had recourse to a curious mode of convincing your readers of the correctness of his assertions. He states

that in my table (or rather his own) the speed of the propeller does not accord with the pitch of the propeller we used when making those experiments, yet no *other pitch* is given. He states also, that the stroke of the pump is wrong; he tells us what the throw does not reach, but characteristically forgets to chronicle what it *did reach*. He has, however, to make up for the deficiency, discovered and presented gratuitously to your readers the *fact*, that *vapour* is given off from water entering the barrel of a pump in *different volumes* at *different temperatures*, and that water when relieved from pressure will boil over! In like manner, he informed us in his former paper, that the pressure was taken by a steam gauge, but *omitted* mentioning that the said steam gauge, though affixed to the boiler, is connected by a small pipe *leading into the slide box of the engine*, the pressure in which slide box it indicates, after being wire-drawn from the boiler, which must consequently be pretty near to the effective pressure exerted on the engine, proving the correctness of my calculation as to power, &c., although erroneously stated by Mr. Beale to myself to be the column indicating the pressure in boiler. And lastly, he cautions me that I should have *a good memory*, imagining that I have contradicted myself with regard to the *correct* account of her consumption of fuel. Now if Mr. Beale calls that account *correct* which gives only the gross amount of her consumption of fuel for seven hours, at various velocities varying from 6 to 9 and sometimes reaching 10 miles per hour, without deducting stoppages and other *et ceteras*, then I will acknowledge myself in error—but not till then.

Would it not, Mr. Editor, have been more becoming had Mr. Beale shown to your readers how much I was in error by forwarding *correct data*, instead of dealing so largely in vague assertions unsubstantiated by proof? Until he does this, I must decline making your pages the vehicle for further controversy on this *unrivalled* vessel.

Your correspondent "Scrutator Mechanicus" states that the *Infant Prince* contains only 12-horse power. If such be the fact, I have to bear testimony to her beating the *Anti-John Scott Russell* on several occasions, thereby rivalling both the *Anti-John Scott Russell's* and *Pigmy Giant's unrivalled* performances. And I may here mention that the *Anti-John Scott Russell* is fitted with ordinary paddle-wheels; her length is 53 feet, beam only 6 feet, and mean draught of water FIFTEEN INCHES,—the lines here being different to those of the *Pigmy Giant*. The form of the boat, therefore, it *does* appear (according to this *authority*) *had* "nothing whatever to do with the results obtained." The performance of the *Pigmy Giant* which is *modestly* stated by Mr. Beale to be unrivalled, has been therefore not only rivalled but *totally eclipsed*; and this same audacious *Infant Prince* has had, with less power, the temerity to try that power with the *renowned Anti-John Scott Russell*, a vessel with (mark, reader, the difference!) above *eight times* her *beam in length!* and came off victorious,—passing the *Anti-John Scott Russell*, that had challenged her, easily. Your readers may imagine that the rotary vessel was not in bad order, or she would not have dared her superior to the trial; thus proving, I think, that 12-horse reciprocating power is superior to 22-horse rotary power. Perhaps Mr. Beale may attribute this superiority of the *Infant Prince* to the *decreased* power and *increased* midship section as shown, in comparing her with the *Pigmy Giant*. In his next, perhaps, he will be good enough to explain to your readers how all this has happened, since it has been publicly stated in your Number for November 4th, 1843, and also in the *Civil Engineer*, (the editor of which is "the scientific gentleman" alluded to in his former paper,) and, if untrue, has not been contradicted by him, that 40 pounds pressure produced 225 revolutions of the engine, while in the "Summary," in one of the columns which is his own and not that portion said to be concocted by myself, it is there shown to require a pressure of 60 lbs. to the square inch in boiler, to produce 203·02 revolutions of the said engine, and that a pressure of *only* 40 lbs. to the inch, will produce only 165 revolutions. And this, be it remarked, in the same vessel with the *same* engine, *same* boiler, and the *same Blaxland's propeller*. If both statements be correct, the accuracy of which be it remembered has not been denied by him, then the density of the Thames water must vary pretty considerably I *calculate*, since I know of no other cause which would effect, all other circumstances remaining the same, a reduction of *sixty* revolutions of the engine per minute.

I am, Sir, your obedient servant,

E. W. BAKER.

THE "INFANT PRINCE."—MR. BEALE'S ROTARY ENGINE.

Sir,—In compliance with your correspondent, Mr. John Beale's inquiry, I beg leave to furnish the following particulars relative to the *Infant Prince*. The diame-

ter of her cylinder is 8 inches; length of stroke 12 inches; number of strokes per minute, 80; the pressure in the boiler *never* above 45 pounds to the square inch. With regard to her consumption of fuel I possess no correct account, but can inform him, that in a run of six hours, during part of which period she proceeded from Deptford to Gravesend and back, she only consumed five cwt. of oven coke: had I stated 19 feet of immersed midship section I should have been nearer the truth.

I consider the engine one of the class denominated the "Fourth" by Mr. John Scott Russell, and described as that of the revolving piston. Mr. Beale's engine consists, according to his patent, of a cylinder provided with two end plates and an axle, which axle contains four pockets, in which pockets are placed four rollers, which when in motion are thrown out and kept in contact with the cylinder by their own centrifugal force, but provided with pins passing through the axis of the axle, (as shown in the *Mechanics' Magazine*, No. 1056,) to force them out until sufficient velocity is arrived at to bring the centrifugal force into action, thus forming a revolving piston; such axis and rollers otherwise touching *against each end*, as steam would pass. It will be perceived that they must fit therefore, or steam would be wasted.

How long they will continue so to fit is admirably answered by Mr. J. S. Russell, on the "fallacy of rotary engines," extracts of which were given in your useful work, No. 776 for June, 1838. I think I need make no apology for again bringing his remarks before your readers. He states as follows:—

"It is a received principle in constructing machines, that, in a good engine, the parts should wear equally, and that even the very working of their parts should make them fit each other better,—this is truly the case with the piston and cylinder and other appendages of the reciprocating steam engine, so true, that old engines of Messrs. Watt and Boulton, some of their earliest, are still working better than they ever did, or than some more recently made. To this the *rotary* engine necessarily presents a contrast, and it will not be difficult to show that its parts *must* wear unequally, so as to become unfit for use, and be rendered by each day's work less fit for the duty of the succeeding one.

"To show the cause of this: suppose two perfectly *flat plates* of metal perfectly round, to be laid one upon the other, so as exactly to coincide at every point; let the undermost rest upon a table, and let the uppermost be so made as to *turn round on an axis* while in contact with the other, and let a rapid motion be communicated to the uppermost,—let me ask what will be the result of the attrition of the one of these upon the other? Will they wear equally, so as to remain in a state of mutual adaptation, or will they not? Experience furnishes an answer which exactly graduates with reasonable expectation—they will *not* wear equally, —they will not retain their forms. Let it be considered that the *outer edge* performs a larger circuit than any part nearer the centre; that, therefore, as all the parts revolve in the same time, those *nearer the circumference* move with a greater velocity than those towards the centre; that the attrition is most rapid at the circumference, and uniformly diminishes towards the centre of the plate—then it inevitably follows that *the plates must become conical*, with a continual tendency to become more so. This is a most incontestable truth; it is one which has caused the failure of many beautiful inventions, it is the reason why conical bearings have been universally abandoned for cylindrical ones; and it is the cause that has rendered a most beautiful class of inventions totally useless, to the improvements of the reciprocating engine. I allude to the *flat revolving cones* introduced by Oliver Evans, and afterwards brought into this country, but now universally abandoned in spite of *simplicity*, *efficiency*, and *economy*, on account of this very attrition from a centre, which we consider to be ruinous to every steam-engine upon a *revolving principle*."

As Mr. Beale cites an instance of the success of his plan, I hope I may be allowed to cite another. I will not give an account of a trip of an engine on this plan from Yorkshire to London, but will confine myself to London, and beg leave to ask him whether it be true, as I have been informed, that in one of his rotary engines the cylinder required to be re-bored, the end plates to be fresh faced, and the axle to be altered? If so, are these not rather more than 'trifling repairs?'"

I would also, before concluding, direct the attention of your readers to rather a disingenuous circumstance, namely, the altering of *stroke* into *throw* in Mr. Baker's paper, which he seems not to account for. Now I need scarcely inform your readers that it *does not* require a *throw* of $2\frac{1}{2}$ inches to obtain a $3\frac{1}{2}$ inch *stroke*. Mr. Beale seems to deal largely in assertions of the ignorance of others; he should therefore studiously avoid rendering his own too apparent.

Sir, your obedient servant,

SCRUTATOR MECHANICUS.

P.S. In the accounts in the daily papers of the explosion of the *Propeller's* boiler, it

is erroneously stated that she was fitted with the Archimedean screw: such is not the fact. She has now the common paddle-wheel, but used to be fitted with "Melville's Patent Propellers." She was constructed by Mr. Beale, and used to ply between Blackwall and Greenwich. The boiler used not to generate *sufficient* steam. I should therefore rather imagine the explosion was caused by a deficiency of water—the pumps not throwing the required quantity to keep the boiler properly supplied.

Greenwich, Dec. 23, 1844.

THE ORIGINAL INTRODUCER OF WOOD PAVING.

Sir,—Having observed in a late Number of your useful periodical my name mentioned in connexion with the law-suits about wood pavement, and having observed that my communication to the Society of Arts has been referred to in every trial on this subject, I take the liberty of communicating to you a real statement of my claims to be considered as the original introducer of this novel and widely-spreading method of paving streets.

Having had the honour of being in the service of the Emperor of Russia for the last twenty-five years, my opportunities of visiting England have, of course, been few; so that it has been chiefly by means of the newspapers, and your Magazine, that I have been informed of the spread of this and other improvements in my native country. In 1832, having obtained leave of absence for a year, I returned to England, and found, at that time, several of the principal streets macadamized. I was informed that, besides being exceedingly expensive, that method was very defective for cities, on account of the mud produced in wet, and the dust in dry weather. In urging on the notice of the public a method of paving their streets less expensive, and at the same time free from the annoyances of both mud and dust, I flattered myself that I was rendering an essential service. I was advised to take out a patent, and thus secure to myself a monopoly of the advantages that might accrue from the adoption of my plan; but this I declined doing, partly on account of my foreign service precluding me from paying the necessary attention to such an enterprise, and partly with the vague hope that, if my suggestion should be so extensively adopted as to become a public benefit, the Government might be induced, as in the case of Mr. Macadam, to make me some compensation for foregoing the advantages of a monopoly. I therefore made the communication to the Society of Arts, that was published in their journal of 1833, and for which a letter of thanks was voted to me. From that time I had no opportunity of revisiting England until last summer (1843); and although, by the great number of patents taken out for various modifications of the plan proposed by me, and the continual law-suits among the patentees, I was aware that it had excited considerable interest; yet, on my arrival in London, I was agreeably surprised at seeing most of the principal streets of the metropolis paved with blocks of wood, and at hearing from the inhabitants, that since the introduction of gas nothing had so much contributed to their comfort as the wooden pavement, which had effectually banished the incessant din and intolerable rattle that used formerly almost to deafen them. This was certainly gratifying for me to hear, and encouraged me to hope that the introducer of this public benefit had some claim on the government of the country for a recompense; at all events, I resolved, before I returned to Russia, to give them an opportunity of displaying their liberality if so inclined; and as Sir Robert Peel was Vice-President of the Society of Arts, at the time the thanks of the Society were voted me, I, having previously obtained the sanction of His Excellency the Russian Ambassador, addressed the following letter to him:—

"*To Her Majesty's principal Secretary of State, the Right Honourable Sir Robert Peel.*

"*London-road, Brighton,*
"*October*, 1843.

"Sir,—Numerous instances might be cited, in which the Government of this country has liberally and wisely rewarded individuals, who, regardless of their own private interests, had, by their inventions and improvements, contributed to the public comfort or prosperity. It was my confidence in this just and liberal spirit of the British Government, that induced me, contrary to the advice of my friends, to forego the advantages of a patent, and freely

and unreservedly to communicate to the public, through the medium of the Society of Arts, which at that time (1832) could boast of having you, Sir, for one of its Vice-Presidents, a new method of paving the streets with blocks of wood. The publication of this communication, in the transactions of the Society in 1833, led to an extensive and daily increasing adoption of the wood pavement in the streets of London, and numerous testimonials might be produced of the extreme satisfaction of the inhabitants at the change. Various modifications have been adopted in the application, but all founded on the method first recommended by me. Perhaps, Sir, you may deem it consistent with your duty as a minister of the crown, and in accordance with former precedents, to advise Her Majesty to bestow some adequate recompense on the introducer of an improvement, calculated to have no small influence on the comfort of the inhabitants of cities, in consideration of the invention having been freely and unreservedly communicated for the good of the public, without any view to private emolument. Should such be the view, Sir, which you are pleased to take of this proceeding, it may reasonably be anticipated that the example will not be thrown away, but that it will encourage others to bring from distant countries inventions calculated to increase the happiness and prosperity of this great empire.

"I have the honour to be, &c.,

"(Signed.) James Arthur Heard,
Officer in the Civil Service of His Majesty the Emperor of Russia, and Knight of the Imperial Order of St. Stanislaus."

In answer to this letter, I received a prompt and laconic reply from Sir Robert Peel, simply stating that he had no power to grant any reward for the service I had rendered the public. Shortly afterwards, I returned to Russia, consoling myself with the thought, that I had the happiness of serving a munificently generous sovereign, who never allows to go unrewarded an individual, who has contributed to the public comfort or prosperity.

Like every other improvement, the new mode of paving has met with opposers and detractors; but a sufficient proof that the advantages outbalance the inconveniences is afforded by its rapid and continual spread through all the principal streets of the metropolis. The chief, and almost the only objection urged against it is its slipperiness. Now, a wooden road is not necessarily a slippery one; but this defect is an accidental circumstance, arising from the great quantity of mud that is brought on to the wood from the stone pavement; and as the streets of London are as yet only partially paved with wood, and the stone pavement is notoriously filthy in wet weather, the continual passage of vehicles from the one to the other must of course cover the blocks with a coating of the greasy mud produced exclusively on the granite pavement. For the last ten years I have driven almost daily through the Nevsky Perspective (a wooden road kept scrupulously clean), and during all that time my horses never once slipped or fell on the wooden pavement. If all the streets of London were paved with wood, there would be no mud, and, consequently, no slipperiness. In the enumeration of the various advantages of this method, I do not remember ever to have seen anything concerning the saving that would result in the item of horse-keep, from the increased power of traction over such a road as compared with the ordinary granite pavement. This increase has been ascertained by experiment to be more than 50 per cent.; so that, if all the streets were uniformly paved with wood, in every case where two horses are kept one might be dispensed with; in addition to which, the expense of watering the streets would be entirely superseded.

Craving your pardon for the length of this letter, I have the honour to remain,

Yours, respectfully,

James Heard.

DIRECT-ACTION ENGINES—THE INVENTION OF THE LATE WILLIAM SYMINGTON.

Sir,—As the rage of the conflict for priority in the application of direct-acting engines, between the engineers of

the Thames and those of the Clyde has long since subsided, it is not my intention to again stir up that agitation by the following remarks; but seeing of how much interest the subject was to the respectable, intelligent, and influential portion of the scientific world who engaged in it, I trust it will not even now be deemed too late or out of place, to offer a few words in favour of the real, true, and original inventor of that application. Perhaps it is not generally known that the late William Symington, who has had his claim to be the first who applied steam to the purposes of navigation so fully and incontrovertibly established, was also the first to propose the application of the steam-engine in that form generally known in these times as *direct acting*. This is a fact, however, which happens to stand recorded in a document inrolled in the Court of Chancery (which the other day came under my notice for the first time), and is, therefore, beyond all dispute. On reading it, I was forcibly reminded of a similar circumstance in the case of James Watt, who, in his first improvements on the steam-engine, proposed several simple variations in the working parts, of which others afterwards, and even of late date, have thought they were the first inventors. Mr. Symington, after his grand invention of the application of steam to navigation, took out letters patent in the year 1801 for an engine suitable for this purpose. The drawing which he gives in his specification of this patent represents the engine in that position and form known as the horizontal engine, that is, having the cylinder laid on its side, the piston-rod working backwards and forwards in a horizontal direction, and being at once connected by means of a rod to the crank-pin. After describing his engine, as thus represented, Mr. Symington says that it would answer equally well with the cylinder in an erect position, with the piston-rod at once connected by a rod to the crank-shaft for turning the paddle-wheels, &c. It is surely but fair that where the merit is, that there it should be awarded. Although Mr. Symington had a patent for this highly useful invention, it is more than likely that the only advantage he derived from it was that of being permitted to pay the expenses of the patent—a title which conferred in those days a much less amount of protection than it does in the more enlightened times in which we live.

The insertion of the above in your Magazine, which has been the instrument of vindicating the rights of so many original inventors, will confer a favour on, Sir, Yours truly,

S. A. MILNE.

COAL-MINE ACCIDENTS.

Sir,—The readiness with which you have printed my suggestions as to the possibility of illuminating coal-mines, and which, I am happy to find, coincide with those of the inventor of the Bude light, does credit to your humanity; for in the present state of our ignorance of the certainty of Davy's lamps being a security, it becomes our duty to consider if there be not some other method of preventing the dreadful loss of lives attendant on excavating coal. It now appears from the proceedings at the coroner's inquest at Haswell, as well as from the reports made by the three scientific gentlemen who examined the scene of the deplorable accident at that place, that ignorance or avarice on the part of the owners of mines, is a main source of the frequent accidents that occur. From a desire to save the expense of props in the worked-out parts, falls from above of imperfect but inflammable coal-measures are permitted, which produce so many *goafs*, or dens, for the engendering of inflammable gas, so that after a series of years the whole of the upper parts of these goafs are converted into irregular gasometers, ready, on the approach of fire, for explosion. Now, sir, as in many cases it would be very difficult to pump out from these honeycomb-recesses this dangerous intruder, it becomes a matter well worth consideration, whether, by the introduction of steam, its inflammable qualities might not be destroyed; or whether by piercing, by means of the Artesian process, into the centre of these goafs, we might not burn out this accumulated mischief, on its rising to the surface of the earth. Other plans have been thought of, such as introducing atmospheric air by tubes, or walling up the whole circumference of the goaf; but I think that, for the future, it should be enacted by Act of Parliament, that, where coals are excavated, walls should

be built to support the ceiling of the mine, or that wooden props of the larch-tree, which is a wood that resists all humidity, should be substituted. I am persuaded that, until Government take up this business steadily, the greediness of gain will continue to make men indifferent to the protection of the lives of their fellow-creatures.

I remain, sir, yours, &c.,
GEO. CUMBERLAND, Sen.

THE ATMOSPHERIC RAILWAY—THE CLOSING OF THE PISTON GROOVE—HALLETTE'S SYSTEM.

Sir,—I have read with much interest and gratification your account of Mr. Pilbrow's improved method of atmospheric propulsion, and am inclined with you to anticipate the best results from it. Will you allow me, however, to notice what appears to me to be rather a palpable defect in your article on the subject—namely, that it is limited to a comparison of Mr. Pilbrow's system with that of Messrs. Clegg and Samuda? Why has it not been contrasted with others as well? With the plan of Hallette, of France, for example—of which, by the way, I do not remember to have met with any account in your pages? Trusting to see *both* omissions supplied in an early Number by Mr. Pilbrow or by yourself,

I am, Sir, your constant reader,
C. E.

Note.

The exception taken by our correspondent to the account given by us of Mr. Pilbrow's invention is reasonable. We subjoin a description of the method of M. Hallette, to which he refers (extracted from the *Leeds Mercury*), and invite Mr. Pilbrow to point out in what respects and to what extent he considers it to be inferior to his own.

"The means contrived by Clegg and Samuda for attaching the carriages to the piston was, to make a groove along the tube, covered with a leathern flap, which, being weighted, and covered with wax, allows a cable or bar connecting the piston with the carriages to traverse,—opening with ease to admit the passage of the cable, and closing after it, so as almost, but not entirely, to prevent the admission of air. The apparatus is extremely ingenious, but it is complicated, and allows of a leakage which the patentees calculate as equal to 15 per cent. of the power employed to exhaust the air, though Mr. Robert Stephenson believes it to amount to 36 per cent., and even at the higher velocities to 74 per cent.

"M. Hallette has endeavoured to imitate nature, by providing a pair of flexible lips to the groove, which allow of the passage of the piston bar or cable without admitting the air. It is possible, as every one may find on trial, to pass a quill or pencil between the lips from one side of the mouth to the other, without admitting the least air into the mouth or out of it. M. Hallette has made artificial lips, by disposing along the parallel edges of the longitudinal groove two little cylinders, cut laterally, so that the concave of the one cylinder is opposite to the concave of the other; and filling each cylinder with a kind of hollow gut or tube, of leather or other material impermeable to air, which tubes, being filled with compressed air, and lying in close contact with each other, form a kind of *elastic lips*, that open like the lips of man, and allow a bar or cable to pass along them without admitting any air into the large tube.

"Such is the method; and we have seen a letter from M. Hallette to a French gentleman in this town, who acts as his representative, stating that after experiments made publicly on a short railway at Arras, he has proved that the artificial lips placed along the groove of the tube *hermetically* close it, and effectually prevent the admission of air into the exhausted portion of the tube as the piston passes. His invention also affords the means of bringing the piston and train to a stand much more quickly than any other system, and of course it is better adapted than any other to the descent of considerable inclinations.

"M. Arago and other distinguished men of science in France have declared their approbation of M. Hallette's invention; and a commission, composed of Messrs. Charles Dupin, Arago, Seguier, Morin, and Piobert, has been appointed to report upon it to the Académie des Sciences.

"M. Hallette expects that a stationary engine every *five and a quarter* miles will suffice to exhaust the tube, instead of (as by Clegg and Samuda's plan) an engine every *two and a third* miles. If the invention should realize the expectations formed of it, all the advantages of the present Atmospheric Railway will be realized in a higher degree. Railways might be carried over elevations of more than 400 yards; and of course the necessity for tunnels, embankments, and cuttings would be nearly done away, and the expense of the construction of

railways would be exceedingly diminished. Much lighter rails might be used, as the enormous locomotives (which chiefly require the rails to be so strong and heavy) would be done away; and much lighter carriages would also suffice, because collisions would be impossible. The risk of accidents would be reduced to the smallest possible amount. The trains would pass without noise, and with very little vibration. The expense of working the trains would be exceedingly diminished: there would be no need for the large workshops and the great numbers of first-rate mechanics on railways."

NEW LIGHT—OIL, GAS, AND CAMPHINE SUPERSEDED!!!

We extract the following startling announcement from a letter in the *Cincinnati Advertiser*, quoted in the *Jersey Gazette*. How much of it we ought to put faith in, or how much to rank in the same category with Pennsylvanian bonds, we must leave it to time to determine.

"In the *Cincinnati Advertiser*, of the 4th of September, under the head of 'Important Discovery,' I announced the fact, that a new species of light, far surpassing the Drummond in intensity, was about to make its appearance in our city, and would be submitted to public inspection so soon as the necessary letters patent were obtained for the discovery. It was stated that a hall lamp, of ordinary size for table use, had enabled print to be read at a distance of three hundred feet, the glass in this instance being rendered semi-opaque by grinding. This had become necessary to reduce the intensity of light for practical purposes, the full brilliancy being equal to that of the sun at noon day. It was stated, also, that a tower, 200 feet high, or even less, would suffice to light the whole city; and that the tower, when built, could be lighted at an expense of three hundred dollars. Finally, it was alleged that this discovery had been tested for the last five months. When I stated all this, I was perfectly aware that the account would stir up a vast amount of incredulity. As my friend, Wesley Smead, the banker, says, and the remark evinces profound knowledge in temporal matters, 'In the affairs of this world, men are saved not by faith, but by the want of it.' Hence I was prepared to expect and even to justify the sceptical air with which many received the announcement, and the knowing look with which others quizzed me, for being 'sucked in,' as they termed it, to usher it forth to the community.

"I have now the pleasure to say that all this is true, and that, as in the case of the Queen of Sheba, the half has not been told. At that time I was not at liberty to say more, but now state—

"1. That this light is magneto electrical.

"2. That it is produced by permanent magnets, which may be increased to an indefinite extent. The apparatus now finishing by the inventors or discoverers in this case, will contain twenty magnets.

"3. That it supplies a light whose brilliancy is insupportable to the naked eye.

"4. That a tower of adequate height will enable a light to be diffused all over Cincinnati, equal for all practical purposes to that of day.

"5. That this light when once set in operation, will continue to illuminate without one cent of additional expense.

"6. And lastly, that the inventors in this process have nearly solved the long sought problem—perpetual motion. They suppose they have accomplished this, which I doubt, though there is as much evidence for it as I conceive can be furnished to the existence of mesmerism or animal magnetism, sufficient to convince others, if not myself.

"I suppose this light will prove—the great discovery of modern times. It is needless to add how much it gratifies me that Cincinnati is the place, and two of its native sons, J. Milton Sanders and John Starr, the authors of the discovery. Mr. D. A. Sanders has gone on to Washington for letters patent, and on his return public exhibitions will be made of its astonishing capabilities.—The whale, that great sea-lubber, has been elbowed out of the community by the hog, the great land-lubber. Gas for public use has superseded both—alas! for them all, when doomed to be reckoned among the things that were!—I have not time to specify the many uses to which light, independent on combustion, may be applied; and will merely suggest as one, its perfect adaptedness to mining, in which respect it is far superior in efficiency as well as security to Sir Humphrey Davy's safety lamp. Its aid to the Daguerreotypic art alone is invaluable."

DR. URE'S SUPPLEMENT TO HIS DICTIONARY.

[Concluding Notice.]

On the "art and mystery" (as it may be truly called) of fermentation, to which we have incidentally alluded in our preceding remarks on the adulteration of Tobacco, the reader will find much additional and curious

information under the head of "Beer." "Should cockneys," says Dr. Ure, "happen to read what is here said of Bavarian Beer, they will feel no little surprise, mixed with scorn and incredulity, when told that the mystery of brewing is more philosophically studied and incomparably better understood in Munich than in London, and indeed throughout all Bavaria, than in Old England; but such is certainly the fact, as every delicate stomach will experience which is cheered with the beverage of the former capital, and loaded with the *heavy-wet* of the latter. The brief outline here offered to my readers has been carefully drawn from the best sources of information, obtained during several excursions into Germany. It will, I hope, induce the brewers of this country to set more value on chemical science than they have heretofore done, and thereby eventually lead to *a radical reform* of our colossal establishments for extracting from malt a beverage more akin to that of fermented grape-juice, in its freedom from vinegar and gluten, so abundant now in the greater part of the British porters and beers." The following extracts from the author's article on this subject will suffice to show in what the difference between the beer of Bavaria and that of other countries consists.

"The Germans from time immemorial have been habitually beer drinkers, and have exercised much of their technical and scientific skill in the production of beer of many different kinds, some of which are little known to our nation, while one at least, called Bavarian, possesses excellent qualities, entitling it to the attention of all brewers and consumers of this beverage. The peculiarities in the manufacture of Bavarian beer have recently attracted the attention of the most eminent chemists in Germany, especially of Professor Liebig, and much new light has thereby been thrown upon this curious portion of vegetable chemistry, which I shall endeavour to reflect upon the present article.

"The following is a list of the principal beers at present brewed in Germany.

"1. Brown beer of Merseburg; of pure barley malt.
2. " " barley malt and beet-root sugar.
3. " barley malt, potatoes, and beet-root syrup.
4. " refined beet-root syrup alone.
5. Covent or thin beer.
6. Berlin white beer, or the Champagne of the north.
7. Broyhan, a famous Hanoverian beer.
8. Double beer of Grünthal.
9. Bavarian beer; 1. Summer beer; 2. Winter beer.
10. " Bock-beer.
11. Wheat *Lager*-beer (slowly fermented).
12. White bitter beer of Erlangen.

"Considerable interest among men of science, in favour of the Bavarian beer process, has been excited ever since the appearance of Liebig's Organic Chemistry, first published about three years ago. In the introduction to this admirable work, he says, 'The beers of England and France, and the most part of those of Germany, become gradually sour by contact of air. This defect does not belong to the beers of Bavaria, which may be preserved at pleasure in half-full casks, as well as full ones, without alteration in the air. This precious quality must be ascribed to a peculiar process, employed for fermenting the wort, called in German *untergährung*, or fermentation from below; which has solved one of the finest theoretical problems.

"Wort is proportionally richer in soluble gluten than in sugar.* When it is set to ferment by the ordinary process, it evolves a large quantity of yeast, in the state of a thick froth, with bubbles of carbonic acid gas attached to it, whereby it is floated to the surface of the liquid. This phenomenon is easily explained. In the body of the wort, alongside of particles of sugar decomposing there are particles of gluten being oxidised at the same time, and enveloping as it were the former particles, whence the carbonic acid of the sugar and the insoluble ferment from the gluten being simultaneously produced, should mutually adhere. When the metamorphosis of the sugar is completed, there remains still a large quantity of gluten

* It does not surely contain more gluten than it does sugar, at least no experiments, known to me, prove this proportion.

dissolved in the fermented liquor, which gluten, in virtue of its tendency to appropriate oxygen, and to get decomposed, induces also the transformation of the alcohol into acetic acid (vinegar). But were all the matters susceptible of oxydizement as well as this vinegar ferment removed, the beer would thereby lose its faculty of becoming sour. These conditions are duly fulfilled in the process followed in Bavaria.

"In that country the malt-wort is set to ferment in open backs, with an extensive surface, and placed in cool cellars, having an atmospheric temperature not exceeding 8° or 10° centigrade (46½° or 50° F.). The operation lasts from three to four weeks; the carbonic acid is disengaged, not in large bubbles that burst on the surface of the liquid, but in very small vesicles, like those of a mineral water, or of a liquor saturated with carbonic acid, when the pressure is removed. The surface of the fermenting wort is always in contact with the oxygen of the atmosphere, as it is hardly covered with froth, and as all the yeast is deposited at the bottom of the back under the form of a very viscid sediment, called in German *unterhefe*.

"In order to form an exact idea of the difference between the two processes of fermentation, it must be borne in mind that the metamorphosis of gluten and azotized bodies in general is accomplished successively in two principal periods, and that it is in the *first* that the gluten is transformed in the interior of the liquid into an insoluble ferment, and that it separates alongside of the carbonic acid proceeding from the sugar. This separation is the consequence of an absorption of oxygen. It is, however, hardly possible to decide if this oxygen comes from the sugar, from the water, or even from an intestine change of the gluten itself; or, in other words, whether the oxygen combines directly with the gluten, to give it a higher degree of oxidation, or whether it lays hold of its hydrogen to form water.

"This oxidation of the gluten, from whichever cause, and the transformation of the sugar into carbonic acid and alcohol, are two actions so correlated that by an exclusion of the one, the other is immediately stopped.

"The superficial ferment (*oberhefe* in German) which covers the surface of the fermenting works is gluten oxidized in a state of putrefaction; and the ferment of deposit is the gluten oxidized in a state of *érémacausie*.

"The surface yeast, or barm, excites in liquids containing sugar and gluten the same alteration which itself is undergoing, whereby the sugar and the gluten suffer a rapid and tumultuous metamorphosis. We may form an exact idea of the different states of these two kinds of yeast by comparing the superficial to vegetable matters putrefying at the bottom of a marsh, and the bottom yeast to the rotting of wood in a state of *érémacausie*, that is, of slow combustion. The peculiar condition of the elements of the sediment ferment causes them to act upon the elements of the sugar in an extremely slow manner, and excites the change into alcohol and carbonic acid, without that of the dissolved gluten.

"Sugar, which at ordinary temperatures has no tendency to combine with oxygen, enters in the above predicament into fermentation; but the action is rendered much slower by the low temperature, while the affinity of the dissolved gluten for the oxygen of the air is aided by the contact of the sediment. The superficial yeast may be removed without stopping the fermentation, but the under yeast cannot be removed without arresting all the phenomena of disoxidation of the second period. These would immediately cease; and if the temperature were now raised, they would be succeeded by the phenomena of the first period. The deposit does not excite the phenomena of tumultuous fermentation, for which reason it is totally unfit for panification (bread-baking), while the superficial yeast alone is suitable to this purpose.

"If to wort at a temperature of from 46½° to 50° F. the top yeast be added, a quiet slow fermentation is produced, but one accompanied with a rising up of the mass, while yeast collects both at the surface and bottom of the backs. If this deposit be removed to make use of it in other operations, it acquires by little and little the characters of the *unterhefe*, and becomes incapable of exciting the phenomena of the first fermenting period, causing only, at 59° F., those of the second; namely, sedimentary fermentation. It must be carefully observed that the right *unterhefe* is not the precipitate which falls to the bottom of backs in the ordinary fermentation of beer, but is a matter entirely different. Peculiar pains must be taken to get it genuine, and in a proper condition at the commencement. Hence the brewers of Hessia and Prussia, who wished to make Bavarian beer, found it more to their interest to send for the article to Wurtzburg, or Bamberg, in Bavaria, than to prepare it themselves. When once the due primary fermentation has been established and well regulated in a brewery, abundance of the true *unterhefe* may be obtained.

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"In several states of the German con-

federation, the favourable influence of a rational process of fermentation upon the quality of the beers has been fully recognised. In the Grand Duchy of Hesse considerable premiums were proposed for the brewing of beer according to the process pursued in Bavaria, which were decreed to those brewers who were able to prove that their product (neither strong nor highly hopped) had kept six months in the casks without becoming at all sour. When the first trials were being made several thousand barrels were spoiled, till eventually experience led to the discovery of the true practical conditions which theory had foreseen and prescribed.

"Neither the richness in alcohol, nor in hops, nor both combined, can hinder ordinary beer from getting tart. In England, says Liebig, an immense capital is sacrificed to preserve the better sorts of ale and porter from souring, by leaving them for several years in enormous tuns quite full, and very well closed, while their tops are covered with sand. This treatment is identical with that applied to wines to make them deposit the wine-stone. A slight transpiration of air goes on in this case through the pores of the wood; but the quantity of azotized matter contained in the beer is so great, relatively to the proportion of oxygen admitted, that this element cannot act upon the alcohol. And yet the beer thus managed will not keep sweet more than two months in smaller casks to which air has access. The grand secret of the Munich brewers is to conduct the fermentation of the wort at too low a temperature to permit of the acetification of the alcohol, and to cause all the azotized matters to be completely separated by the intervention of the oxygen of the air, and not by the sacrifice of the sugar. It is only in March and October that the good store beer is begun to be made in Bavaria.

"In our ordinary breweries, the copious disengagement of carbonic acid from the frothy top of the fermenting tuns and gyles prevents the contact of oxygen from the worts; so that, as the gluten cannot be oxdized by the air, it attracts oxygen from the sugar, and thus gives rise to several adventitious hydrogenated products, just as the fetid oil is generated in the rapid fermentation of spirit wash by the distillers. In this case no inconsiderable portion of the gluten remains undecomposed in the beer, which, by its extreme proneness to corruption, afterwards attracts oxygen greedily from the air, and, at temperatures above 52°, imparts this *contact action* to the alcohol, and, by a species of infection, changes it into vinegar. Indeed, in most of the rapid fermentations a portion of vinegar is formed, which itself serves as an acetous ferment to the rest of the alcohol: whereas the result of the *bottom* fermentation is a beer free from vinegar, and certainly hardly a trace of gluten; so that it does not possess the conditions requisite to intestine change or deterioration. This perfection is, however, in my opinion, rarely attained. In my several journeys into Germany I have met with much spurious or ill-made Bavarian beer. The best contains, when brought to England, a little acid, but no perceptible gluten on the addition of ammonia in excess. Most of our beers, ales, &c., deposit more or less gluten when thus treated."

The admission which Dr. Ure makes as to the indifferent quality not only of the samples of Bavarian beer which one occasionally meets with in this country, but of much of that made in Bavaria itself, may help to account for the fact, that notwithstanding the superiority which he assigns to it on scientific grounds, it is still far from rivalling in popular estimation all over the world, our own London Porter. Perhaps, too, the doubting reader may discover in the following analysis of *genuine* London porter, furnished by Dr. Ure, some reasons for thinking that there is after all not so much "Death in the Pot" *when so filled*, as his other statements would lead us to believe.

"*Porter and Brown Stout.*—I offer the following statement of the process for brewing genuine London porter, believing it to be more near that really practised than any formula hitherto published.

"For 180 barrels of brown stout, containing from 80 to 85 parts of malt extract in 1000 by weight:—

"*Components.*—530 bushels (English measure) of good barley malt.
10 do. of kiln-browned malt.
12 cwt. of *Essentia-bina*, *Caramel*, or sugar fused over a fire into a dark brown or black syrupy mass.
1500 lbs. of hops, or about 3 pounds to each bushel of malt.
10 quarts of *Calfini*, a preparation made with the oil distilled from the outer bark of the birch.
5 quarts of good porter yeast.
finings of isinglass dissolved in sour beer.

"For the brewing process see Beer in the Dictionary.

"The *essentia-bina* may be dissolved in hot worts in a separate copper, and mixed with the rest by running it into the cooler, immediately after the boiled wort is strained from the hops in the hop-back. The *Calfini* (a *hocus-pocus* term of the brewers) is prepared as follows:—

"Put one ounce of birch-bark oil into a bottle with 4 quarts of spirits of wine 60 per cent. over proof; cork the mouth of the bottle, and place it in a slightly warm position till the oil be thoroughly combined with the alcohol, with the aid of occasional shaking. This solution being cooled is to be filtered through paper, and kept for use. The birch oil is an empyreumatic product made in large quantities in Russia and Poland, for the purpose of giving flavour and conservative properties to the Russia leather. It is sold for one shilling the quart. The dose of *Calfini* in porter is varied according to the taste of the brewers and consumers."

Besides being better brewers than we are, the Germans claim to be also quicker, if not better, vinegar makers; but, in this respect, Dr. Ure deems their pretensions unfounded.

"*Rapid acetification*, or the quick formation of vinegar, was practised upon malt worts in this country long before the rapid conversion of alchol into vinegar was introduced into Germany. In the year 1842, Mr. Ham obtained his patent for an improved method of making vinegar, which is described in the Dictionary. His son, Mr. F. Ham, of Norwich, civil engineer, states that for some years, four of the largest country manufactories in the kingdom have been at work upon his father's plan, and that they are now in successful competition with the great London establishments. The apparatus consists of a huge vat, in the centre of which is a revolving pump, having two or more shoots pierced with holes, whereby a constant shower of the fermented wort, called wash, is kept falling from the top. The under part of the vat contains the wash; the upper part, birch twigs properly prepared, which are so placed as not to interfere with the revolving shoots. Between the surface of the wash and the rafters which support the twigs, a space of a few inches is left vacant, into which one or more holes in the side of the vat admit the air spontaneously or have it forced in. The wash is maintained by steam pipes immersed in it, at a temperature of from 90° to 100° F., so that, in consequence of the extensive application of the atmospheric oxygen during the trickling through the twigs, it may be made sour in the course of 48 hours; but, in general practice, it is completely acetified in from 15 to 20 days. By this apparatus, a wort brewed from raw grain, with only one-seventh of malt, will produce a vinegar equal to that from malt alone; and the acetifying process may be arrested whenever it is completed, thus preventing the risk of the vinegar running into the putrefactive stage, as happens occasionally in the slow plan of fermentation. The admission of air is so moderated as not to dissipate the alcohol of the wash by evaporation. A wort of 24 lbs. gravity per Richardson's instrument, equal to 1·066 sp. gravity, will in this way yield an acid of revenue proof."

To all who are fonder of "Tea," than either London Porter, Bavarian Beer, or any other product of fermentation whatever, we would recommend an attentive perusal of the article given under that head. It will be found fraught with consolation and comfort to millions; showing beyond all dispute that instead of having the enervating effect very commonly supposed, it "contributes a salutary and powerful aid" to the "organic functions." The same thing appears to be also true of Coffee, Chocolate, and Cocoa.

"Tea. This well-known plant has recently acquired peculiar interest among men of science, both in a chemical and physiological point of view. In its composition it approaches by the quantity of azote it contains to animalized matter, and it seems thereby qualified, according to Liebig, to exercise an extraordinary action on some of the functions of animals, especially the secretion of bile. The chemical principle characteristic of tea, coffee, and cocoa beans, is one and the same when equally purified, from whichever of these substances it is extracted; and is called indifferently either Thiene or Caffeine. Mulder takes it from tea, by treating the evaporated extract by hot water, with calcined magnesia, filtering the mixture, evaporating to dryness the liquor which passes through, and digesting the residuum in ether. This solution being distilled, the ether passes over, and the theine remains in the retort. This principle is extracted in the same way from ground raw coffee and from *guarana*, a preparation of the seeds of *Paullinia*, highly valued by the Brazilians. Theine, when pure, crystallises in fine glossy needles, like white silk, which lose, at the heat of boiling water, 8 per cent. of their weight, constituting its two atoms of water of crystallization. These

needles are better tasted. They melt at 350° F. and sublime at 543° without decomposing. The crystals dried at 250° dissolve in 98 parts of cold water, 97 of alcohol, and 194 of ether. In their ordinary state, they are but little more soluble in these menstrua. Theine is a feeble base, and is precipitable by tannin alone from its solutions.

"Mr. Stenhouse prepares theine by precipitating a decoction of tea with solution of acetate of lead, evaporating the filtered liquor to a dry extract, and exposing this extract to a subliming heat in a shallow iron pan, whose mouth is covered flatly with porous paper luted round the edges, as a filter to the vapour, and surmounted with a cap of compact paper, as a receiver to the crystals. In this way he obtained, at a maximum, only 1·37 from 100·00 of tea. But M. Peligot, from the quantity of azote amounting to about 6 per cent., which he found in the tea leaves, being led to believe that much more theine existed in them than had hitherto been obtained, adopted the following improved process of extraction. To the hot infusion of tea, subacetate of lead and then ammonia were added; through the filtered liquor a current of sulphurated hydrogen was passed to throw down all the lead, and the clear liquid being evaporated at a gentle heat afforded, on cooling, an abundant crop of crystals. By re-evaporation of the mother liquor, more crystals were procured, amounting altogether to from 5 to 6 out of 100 of tea.

"The composition of theine may be represented by the chemical formula, C^8, H^5, N^2, O^2; whence it appears to contain no less than 29 per cent. of nitrogen or azote.

"Peligot found, on an average, in 100 parts of—

	Parts soluble in boiling Water.
Dried black teas . . .	43·2
—— green teas . . .	47·1
Black teas, as sold . . .	38·4
Green teas, ditto . . .	43·4

"Tea, by Mulder's general analysis, has a very complex constitution; 100 parts contain—

	Green.	Black.
Essential oil (to which the flavour is due) .	0·79	0·60
Chlorophyle (leaf-green matter)	2·22	1·84
Wax	0·28	
Resin	2·22	3·64
Gum	8·56	7·28
Tannin	17·80	12·88
Theine	0·43*	0·46
Extractive matter .	22·80	19·88
Do., dark-coloured	—	1·48
Colourable matter separable by muriatic acid	23·60	19·12
Albumine . . .	3·00	2·80
Vegetable fibre . .	17·08	28·32
Ashes . . .	5·56	5·24

* This constituent is obviously much underrated.

"Since the proportion of azote in theine and caffeine is so much greater than even in any animal compound, urea and uric acid excepted, and since so many different nations have been, as it were, instinctively led to the extensive use of tea, coffee, and chocolate or cocoa, as articles of food and enlivening beverage, which agree in no feature or property, but in the possession of one peculiar chemical principle, we must conclude that the constitution of these vegetable products is no random freak of nature, but that it has been ordained by Divine Wisdom for performing beneficial effects on the human race. Hitherto, indeed, medicine, a conjectural art, exercised too much by men superficially skilled in the science of nature, and the slaves or abettors of baseless hypotheses, has laid tea and coffee generally under its ban, equally infallible with the multitude, as that of the Pope in the olden time, and has denounced their use, as causing a variety of nervous and other *nosological* maladies. But Chemistry, advancing with her unquenchable torch into the darkest domains of Nature, has now unveiled the mystery, and displayed those elemental transformations of the organic functions in the human body, to which tea and coffee contribute a salutary and powerful aid.

"Liebig, in his admirable researches into the kingdoms of life, has been led to infer that the bile is one of the products resulting from the decomposition of the animal tissues, and that our animal food may be resolved by the action of oxygen, so amply applied to the lungs in respiration, into bile and urea, the characteristic constituent of urine.

"When the consumption of tissue in man is small, as among mankind in the artificial state of life, with little exercise and consequently languid digestion, assimilation, and decomposition, the constant use of substances rich in azotised compounds, closely analagous to the chief principle of the bile, must assist powerfully in the production of this secretion, so essential to the healthy action of the bowels and other organs. Liebig has fully proved that the bile is not an excrementitious fluid, merely to be rejected, as a prejudicial inmate of the system, but that it serves, after secretion, some important purpose in the animal economy, being in particular, subservient to respiration.

"A pure, agreeable, and convenient con-

centrated preparations of tea and coffee has been recently made the subject of an ingenious patent by Mr. Staite, which I can recommend as being made from the best articles in the market, by a perfectly wholesome apparatus and process."

The "Pure concentrated Preparations of Tea and Coffee," referred to at the close of the preceding extract, are the subject of a patent which has not been yet specified. We are necessarily, therefore, left in the dark for the present as to the mode of preparing them; but that they deserve all that Dr. Ure says of them we can ourselves bear unhesitating testimony. We have partaken of both tea and coffee prepared by Mr. Staite's process, and never tasted any that was of a fuller body or finer flavour.

"Gas Light" forms the subject of a long and elaborate article, which is stated to have been "contributed by a most intelligent friend." It abounds in original and useful information. In treating elsewhere, however, of Gas-meters, Dr. Ure has been betrayed, either by the same or some other obliging "friend," into some statements which he will be sorry to learn are grossly erroneous. The meter of Mr. Botten (called by mistake Bottom) is stated to be defective, inasmuch as "it occasions nuisance by letting its overflow water trickle upon the floor;" whereas every meter of this maker has a waste cistern for the express purpose of collecting the overflow water. Mr. Edge's meter, again, is extolled as being superior, not only to Botten's, but every other; when, in point of fact, it is but a bad copy of Botten's—not nearly so simple, and much inferior to it in general efficiency.

We make one more extract:—

"*Floor Cloth Manufacture* has become of late years a very large branch of trade. The cloth is a strong somewhat open canvass, woven of flax with a little hemp, and from six to eight yards wide, being manufactured in appropriate looms, chiefly at Dundee. A piece of this canvas from 60 to 100 feet in length, is secured tight in an upright open frame of oaken bars, in which position it receives the foundation coats of paint, two or three in number, first on the back side, and then on the front; but it previously is brushed over with glue-size, and rubbed smooth with pumice stones. The foundation paint made with linseed oil and ochre, or any cheap colouring matter, is too thick to be applied by the brush, and is therefore spread evenly by a long narrow trowel, held in the right hand, from a patch of it laid on just before with a brush in the left hand of the workman. Each foundation coat of the front surface is smoothed by pumice whenever it is hard enough to bear the operation. When both sides are dry, the painted cloth is detached from the frame, coiled round a roller, in this state transferred to the proper printing room, where it is spread flat on a table, and variously figured and coloured devices are given to it by wooden blocks, exactly as in the block printing of calicoes, and in the wood-printing of books. The blocks of the floor cloth manufacture are formed of two layers of white deal and one of pear-tree timber, placed with their grain crossing one another alternately. There is of course a block for each colour in the pattern, and in each block those parts are cut away that correspond to the impressions given by the others; a practice now well understood in the printing of two or more colours by the press. The faces of the blocks are so indented with fine lines, that they do not take up the paint in a heavy daub from the flat cushion on which it is spread with a brush, but in minute dots, so as to lay on the paint (somewhat thicker than that of the house painter) in a congeries of little dots or teeth, with minute interstices between. Applied in this way, the various pigments lie more evenly, are more sightly, and dry much sooner than if the prominent part of the block which takes up the colour were a smooth surface. The best kinds of floor cloth require from two to three months for their production."

INSTITUTION OF CIVIL ENGINEERS.—TELFORD AND WALKER PREMIUMS, OFFERED FOR SESSION, 1845.

The Council invite communications on the following, as well as other subjects, for Telford and Walker Premiums:—

1. On the Theory of Arches, Abutments, and Piers, comparing the hypotheses of different writers; with practical examples of the application of the theory.

2. The history of the invention of, and the improvements in, oblique Arches, with the theory and the practical methods of setting them out.

3. Experiments on the pressure upon every part of an oblique Arch, especially how the pressure varies as the angles become oblique.

4. On the construction of Retaining and Wharf Walls, with examples of failure and the causes.

5. A description of the Canal of the Helder (Holland), or of any foreign engineering works of a similar kind and importance.

6. The modes of Irrigation in use in Northern Italy; of Drainage adopted in the Lowlands of the United Kingdom: or works of a similar nature in Holland or in other countries.

7. On any of the principal Rivers of the United Kingdom (the Shannon), or of foreign countries (the Po, Italy), describing their physical characteristics, and the engineering works upon them.

8. An account of the waste or increase of the Land on any part of the coast of Great Britain, the nature of the Soil, the direction of the Tides, Currents, Rivers, Estuaries, &c., with the means adopted for retarding or preventing the waste of the land.

9. The principles and practice of constructing Coffer-dams.

10. The best and most economical mode of raising large Stones or Rocks from the beds of Rivers or Harbours.

11. The application of Gunpowder as an instrument of engineering operations.

12. The conveyance of Fluids in Pipes, under pressure, and the circumstances which usually affect the velocity of their currents; with accounts of Water Works and Gas Works.

13. The most advantageous method of employing the power of a Stream of Water, where the height of the fall is greater than can be applied to Water Wheels of the usual construction.

14. Experiments on Water Wheels, Steam Engines, and other machines, with the friction brake.

15. The construction of Cranes for raising and lowering weights.

16. The proportions of large Chimneys, as affecting their draught; with examples and drawings of the construction.

17. The drainage of Mines, exemplified by a statement of the actual condition of some of the Coal-fields or Mining Districts of Great Britain.

18. The ventilation of Coal-pits or Mines in Great Britain or in foreign countries.

19. The construction of Spiral and Fan-blowing Machines, and the power required to drive them, in relation to the pressure and volume of air delivered.

20. The smelting and manufacture of Metals in Great Britain or in foreign countries.

21. The comparative advantages of Iron and Wood, or of both materials combined, as employed in the construction of Steam Vessels; with drawings and descriptions.

22. The sizes of Steam Vessels of all classes, whether river or sea-going, in comparison with their Engine Power; giving the principal dimensions of the Engines and Vessels, draught of water, tonnage, speed, consumption of fuel, &c.

23. The best forms for river and sea-going Steam Vessels; with practical examples.

24. The various modes of propelling Vessels in actual or past use, and their comparative merits.

25. The results of the use of tubular Boilers, and of Steam at an increased pressure, for Marine Engines.

26. On the best application of the principle of Expansion to the improvement of the Steam Engine; with examples of the effect of such application, from actual experiment, and a description of the Engines experimented upon.

27. On the term "Horse Power," as applied to Steam Engines.

28. Description of Pyrometers, for ascertaining the degrees and the fluctuations of the temperature of the Flues of Furnaces, &c.

29. The various modes adopted for moving Earth in Railway Tunnels, Cuttings, or Embankments, with the coast thereof.

30. The proper slopes for Cuttings and Embankments in various soils.

31. Notice of the principal Self-acting Tools employed in the manufacture of Engines and Machines, and the effect of their introduction.

32. On the most effective and best adapted Machines for bruising or crushing the Sugar-cane, and for separating the juice from the vegetable fibre.

33. Memoirs and accounts of the Works and Inventions of any of the following Engineers:—Sir Hugh Middelton; Arthur Woolf; Jonathan Hornblower; Richard Trevithick; William Murdoch (of Soho); and Alexander Nimmo.

Original Papers, Reports, or Designs, of these or other eminent individuals, are peculiarly valuable for the Library of the Institution.

The Communications must be forwarded, on or before the 31st of May, 1845, to the house of the Institution, 25, Great George-street, Westminster, where copies of this paper, and any further information, may be obtained.

Charles Manby, *Secretary*.

25, Great George-street, Westminster, 1844.

Extracts from the Minutes of Council, February 23, 1835.

"The principal subjects for which Premiums will be given, are—

"1st. Descriptions, accompanied by Plans and explanatory Drawings, of any Work in Civil Engineering, as far as absolutely ex-

ecuted; and which shall contain authentic details of the progress of the Work. (Smeaton's Account of the Edystone Lighthouse may be taken as an example.)

"Secondly. Models or Drawings, with descriptions of useful Engines and Machines; Plans of Harbours, Bridges, Roads, Rivers, Canals, Mines, &c. Surveys and Sections of Districts of Country.

"3rdly. Practical Essays on subjects connected with Civil Engineering, such as Geology, Mineralogy, Chemistry, Physics, Mechanic Arts, Statistics, Agriculture, &c.; together with Models, Drawings, or Descriptions of any new and useful Apparatus, or Instruments applicable to the purposes of Engineering or Surveying."

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC., CAP. 65. FROM NOVEMBER 28, TO DECEMBER 23, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Nov. 28	322	James Wilson	18, Old Bond-street, London	Tailors' measuring instrument and drafting scale.
„	323	Joseph Haynes	14, Avenue Road, Regent's Park	Apparatus for extracting corks.
„	324	William Bridges	Croydon	Railway carriage.
30	325	Stephen Green	Prince's-street, Lambeth	Design for having metal legs to a basket containing earthenware bottles.
Dec. 4	326	Josh. Daniel Davidge	50, Rahere-street, Goswell-road	Tubular wick candle.
„	327	Alexander Coombs	26, Denmark-street, St. Giles.	Spring box.
„	328	Frederick Farmer	Brighton	Truss.
6	329	James Kearsley	York	Self folding step for coaches, and other carriages having doors.
7	330	Herbert Room	Bull Ring, Birmingham	Improved kitchener.
10	331	Squire Cheasin	Donnington, Boston, Lincolnshire	Floating filter to be attached to a pump.
12	332	Isaac Julian	Old George's-street, Cork	Scroll spring.
13	333	Wm. Henry Smith.	Wellingborough, Northamptonshire	Euknemida boot, shoe and gaiter fastening.
16	334	Wm. Tabberer, jun.	4, Beaman-row, Birmingham.	Globe fastener for sashes, tables, &c.
18	335	Messrs. Radcliff	Birmingham	Portable bed warmer.
„	336	Ditto	Ditto	The royal bell cushion.
20	337	John Robinson & Co.	4, Nassau-plate, Commercial-road, East	Shirt.
23	338	Willam Smith	Alnwick, Northumberland	Sash-suspension shield.

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN DECEMBER.

An Elementary Course of Mathematics, for the use of the Royal Military Academy, and for Students in general. By S. H. Christie, M. A., of Trinity College, Cambridge, Secretary of the Royal Society, &c., Professor of Mathematics in the Royal Military Academy. Published by the authority of the Master General and the Board of Ordnance. 21s.

An Inquiry relative to various important Points of Seamanship, considered as a branch of Practical Science. Illustrated with numerous Engravings and Tables. By Nicholas Tinmouth, Master Attendant of Her Majesty's Dockyard, Woolwich. 5s. 6d.

The Nautical Almanac for 1848. 5s.

The Art of Weaving by Hand and by Power, with an Introductory Account of the Rise and Progress, in ancient and modern times; for the use of manufacturers and others. By Clinton G. Gilroy, Practical Weaver and Manufacturer. General subjects of the Work:—1. Plain Weaving—2. Tweeling—3. Double Cloth, Marseilles Quilting and Velvets—4. Cross Weaving, comprising Gauze and Net Work—5. Figured Weaving—6. Carpeting, including Ingrain, Brussels, Wilton, Turkey, &c.—7. Lace and Embroidery—8. Plain and Figured Weaving by Power. With numerous Engravings. 1*l*. 11s. 6d.

A Practical Treatise on Cutting. Illustrated with Engravings of 20 Garments. By William Crees, of 50, Castle street, Leicester-square. 13s. 6d.

Original Geometrical Diaper Designs, accompanied by an attempt to develope and elucidate the true Principles of Ornamental Designs, as applied to the Decorative Arts. By D. R. Hay. Author of "Proportions, or the Geometric Principles of Beauty Analyzed." "The Natural Principles and Analogy of the Harmony of Form," and the "Laws of Harmonious Colouring," &c. With 57 Plates and numerous Woodcuts. 42s.

Periodicals.

The Railway Register, and Record of Engineering and Public Works. Edited by Hyde Clarke, Esq. No. 1, price 2s. 6d., 80 pages, with a plate, contains,—Share Speculations; How to Speculate; Anecdotes of Speculators—History of the Atmospheric System—Hydraulic System—Railway Constructors—Broad Gauge.

Other journals as in preceding lists.

LIST OF ENGLISH PATENTS GRANTED BETWEEN NOVEMBER 25, AND DECEMBER 21, 1844.

John Barker Anderson, of Great Suffolk-street, Surrey, for improvements in the manfacture of soap. November 25; six months.

William Clarke, of Nottingham, lace manufacturer, for improvements in the manufacture of ornamental lace or net. November 25; six months.

Benjamin Baillie, of Henry-street, glazier, for improvements in regulating the ventilation of buildings. November 25; six months.

Ebenezer May Dorr, of Ludgate-hill, gentleman, for improvements in the manufacture of horse shoe nails. (Being a communication.) November 25; six months.

William Buckle Reynolds, of Lymington, engineer, for improvements in obtaining motive power for working locomotive carriages and other machinery. November 25; six months.

George Millichap, of Birmingham, for improvements in the construction of axle trees. November 25; six months.

William Oxley English, of Kingston upon Hull, distiller, for improvements in distilling of turpentine and tar, and rectifying volatile spirits and oils. November 25; six months.

William Alsop, of Tabernacle-walk, Middlesex, weaver, and Thomas Forster, of Streatham, manufacturer of india rubber fabrics, for improvements in the manufacture of elastic fabrics, and in making articles from elastic fabrics, and for weaving fabrics for the driving bands of machinery, and other uses. November 25; six months.

Narcisse Leroy, of Paris, merchant, for improvements in covering the tops of bottles, jars, and other vessels. (Being a communication.) November 28; six months.

Louis Antoine Ritterbandt, of Gerrard-street, Soho, doctor of medicine, for certain improvements in preventing and removing incrustation in steam boilers and steam generators. December 2; six months.

James Wrigglesworth, of Bedford-street, Strand, chemist, for an improvement or improvements in steel pens. December 2; six months.

William Henry James, of Clements'-lane, London, civil engineer, for certain improvements in carriages for the conveyance of passengers and goods, and in the means of working the same. December 2; six months.

James Winter, senior, of Wardour-street, Soho, upholsterer, James Winter, junior, of the same place, upholsterer, and William Lane, of Bedford-place, Russell-square, gentleman, for an improved scaffold, or mode of scaffolding, applicable also as a fire-escape for life and property. December 2; six months.

James Nasmyth, of Patricroft, Lancaster, civil engineer, for certain improvements in machinery or apparatus for hewing, dressing, splitting, breaking, stamping, crushing, and pressing stone, or other materials. December 2; six months.

René Joseph Le Compte du Colombier, of Chancery-lane, for improvements in machinery for splitting and cutting skins and hides. December 2; six months.

John Jeremiah Rubery, of Birmingham, umbrella furniture manufacturer, for improvements in the manufacture of umbrellas and parasols. December 2; six months.

Josias Christopher Gamble, of St. Helen's, Lancaster, manufacturing chemist, for improvements in the manufacture of sulphuric acid. December 4; six months.

Benjamin Seebohm, of Horton Grange, York, merchant, for an improved mode of manufacturing certain description of chains. December 4; six months.

John Ronald, of Glasgow, merchant, for an apparatus for boiling sugar-cane juice and other liquids. December 5; six months.

John Ryan, of Liverpool-street, surgeon, for certain improvements applicable to or in the construction of casks, barrels, or other vessels intended to contain wine, beer, fermented liquors, or other liquids or substances which are liable to fermentation or decomposition from exposure to the action of the atmosphere. December 7; six months.

James Smith, of Cross Keys, Wood-street, engineer, for improvements in printing or ornamenting various fabrics. December 7; six months.

William Wood, of High Holborn, manufacturer, for improvements in printing, dyeing, staining, or producing marks or patterns in or upon woven, felted, or other fabrics. December 7; six months.

Thomas Metcalfe, of Eaton-square, Pimlico, brushmaker, for improvements in the manufacture of brooms, brushes, or other similar articles. December 7; six months.

Alphonse René Le Mire de Normandy, of Dalston, gentleman, for improvements in purifying lac, and in converting lac into shellac. Dec. 7; six months.

John Fisher, of Radford works, Nottingham, gentleman, and James Gibbons, of New Radford, machinist, for certain improvements in the manufacture of figured or ornamented lace or net, and other fabrics. December 7; six months.

William Willcocks Sleigh, of Saint James's-square, M.D., for the hydro-mechanic apparatus, which, by a certain combination of hydraulic and mechanical apparatus on well-known philosophical principles is intended to supersede the use of fire and steam in working and propelling all kinds of machinery and engines. December 7; six months.

Joseph Weiger, of Vienna, doctor of medicine, and surgeon-dentist, for improvements in the amalgamation, alloying and soldering of certain metals. December 12; six months.

Charles Louis Felix Franchot, of Paris, engineer, for improvements in engines, to be worked by air or gases. December 12; six months.

William Kenworthy of Blackburn, Lancaster, cotton-spinner, for improvements in looms for weaving. December 12; six months.

William Malins, of Mansion House-place, London, ironmaster, for improvements in constructing roofs and other parts of buildings of iron or other metals, and in the preparation of the materials of which the same are or may be constructed. December 12; six months.

Sebastian Mercier, of Paris, manufacturer of pianofortes, for improvements in pianofortes. December 12; six months.

Robert Heath, the younger, of Shidegreve, Stafford, coal agent, for improvements in heating ovens and kilns used in the manufacture of china, bricks, tiles, and other earthenware. December 12; six months.

Joseph Lockett, of Manchester, engraver, for improvements in apparatus for preparing to be engraved or turned, such copper or other metal cylinders or rollers as are to be used for printing, or embossing, or calendering calico or other fabrics, December 12; six months.

John Perry, of Leicester, wool-comb manufacturer, for improvements in combing wool. December 12; six months.

Moses Poole, of Searle-street, London, gentleman, for improvements in the construction of fids for ship's masts, and in the means of setting up ship's rigging. December 12; six months; being a communication.

George Ferguson Wilson, of Belmont, Vauxhall, gentleman, George Gwynne, of Prince's-street, Cavendish-square, gentleman, and James Pillans Wilson, of Belmont aforesaid, gentleman, for improvements in treating fatty and oily matters, and in the manufacture of candles. December 12; six months.

Warren De la Rue, of Bunhill-row, manufacturer, for improvements in covering the surface of paper and other materials with colour and other substances. December 12; six months.

Robert Walker, of Saint Helen's, Lancaster, colliery agent, for improvements in apparatus for riddling coals in collieries. December 18; six months.

Ralph Knowles Waller, of Manchester, candle wick manufacturer, for improvements in the manufacture of platted wicks, and in the manufacture of candles. December 18; six months.

Nathaniel Fortescue Taylor, of Vauxhall, engineer, for improvements in apparatus for measuring gas. December 18; six months.

Arthur Wall, of Bisterne-place, Poplar, surgeon, for certain improvements in the manufacture of steel, copper, and other metals. December 18; six months.

Edward Hammond Bentall, of Heybridge, Essex, ironfounder, for improvements in implements and apparatus for sowing or depositing seed or grain. December 18; six months.

James Thompson, of Cornwall-road, Lambeth, baker, for certain improvements in the preparation and application of various farinaceous products, and for machinery used in manufacturing the same. December 20; six months.

Benjamin Biram, of Wentworth, Yorkshire, gentleman, for certain improvements in oscillating engines, worked by steam, water, or other fluids, which are also applicable to the raising or propelling of fluids. December 21; six months.

Charles Johnstone, of Southampton, Hants, engineer, for certain improved arrangements for raising ship's anchors, and other purposes. December 21; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 24TH OF SEPTEMBER TO THE 20TH OF DECEMBER, 1844.

Peter Rothwell Jackson of Strawberry Hill, near Manchester, Lancaster, engineer, for certain improvements in the construction and manufacture of wheels, cylinders, hoops and rollers, and in the machinery or apparatus connected therewith, and also improvements in steam valves. September 24.

Wilton George Turner, of Gateshead, Durham, doctor in philosophy, for an improved mode of directing the passage of, and otherwise dealing with, the noxious vapours and other matters arising from chemical works in certain cases. September 25.

Thomas Fuller, of the firm of William Collier and Co., of Manchester, Lancaster, engineer, for certain improvements in machinery, tools or apparatus for turning, boring, and cutting metals and other substances. September 30.

Henry Oliver Robinson, 12, Old Jewry, London, engineer, for certain improvements in steam machinery and apparatus for the manufacture and refining of sugar. October 1.

Pryce Buckley Williams, of Llegodig, Montgomery, North Wales, for certain improvements in the manufacture of artificial stone. October 9.

Jean Baptiste Paul Chappe, of Manchester, Lancaster, spinner and doubler, for certain improvements in machinery or apparatus for spinning and doubling cotton and other fibrous substances. October 9.

Jacob Samuda, of the Southwark Iron Works, engineer, and Joseph d'Aguilar Samuda, of the same place, engineer, for certain improvements in the manufacture and arrangement of parts and apparatus for the construction and working of atmospheric railways. October 10.

William Clarke, of Nottingham, lace manufacturer, for improvements in machinery for manufacturing ornamented bobbin net or twist net. October 15.

William Cormack, of York-street, Commercial-road, Middlesex, manufacturing chemist, for a new or improved method or plan for purifying coal-gas. October 15.

Vice-Admiral Sir Graham Eden Hamond, Baronet, K.C.B., of Norton Lodge, Yarmouth, Isle of Wight, for improvements in the mode of fastening on and reefing paddle-wheel float-boards or paddles. (Being a communication from his son Commander Andrew Snape Hamond, R.N., now commanding her Majesty's steam sloop of war *Salamander*, stationed in the Pacific.) October 15.

George Augustus Kollmann, of the German Chapel, St. James's Palace, Middlesex, gentleman, for certain improvements in railways and locomotive and other carriages. October 16.

William Henry Ritchie, of Lincoln's-inn, Middlesex, gentleman, for improvements in obtaining copper from ores. (Being a communication from abroad.) October 17.

Richard Roberts, of the Globe Works, Manchester, Lancaster, engineer, for certain improvements in machinery or apparatus for the preparation of cotton, wool and flax, and also for spinning and doubling cotton, silk, wool and other fibrous substances. October 19.

John Grieve, of Portobello, Edinburgh, Scotland, engineer, for certain improvements in the production and use of steam, applicable to steam-engines. October 21.

Robert Hazard, of Clifton, Bristol, confectioner, for improvements in baths. October 21.

Pierre Armand le Comte de Fontainemoreau, of Skinner's-place, Sise-lane, London, for a new mode of constructing barometers and other pneumatic instruments. (Being a communication from abroad.) October 22.

John Henry Rehe, of Moscow-road, Middlesex, surgeon, for improvements in the manufacture of starch and farinaceous food. October 22.

Isaiah Davies, of Birmingham, Warwick, engineer, for certain improvements in steam engines, part of which improvements are applicable to impelling wheel-carriages. October 26.

Frederick Steiner, of Hyndburn Cottage, near Accrington, Lancaster, turkey-red dyer, for a new colouring matter to be used in dyeing certain colours on cotton, woollen, silk, and linen fabrics. October 30.

Moses Poole, of Searle-street, London, gentleman, for improvements in machinery for emptying privies and cess-pools. (Being a communication from abroad.) October 30.

Thomas Brown Jordon, of Cottage-road Pimlico, Middlesex, mathematical divider, for improvements in the manufacture of blocks, or surfaces for surface printing, embossing, and moulding. November 11.

George Fergusson Wilson, of Belmont, Vauxhall, Surrey, gentleman; George Gwynne, of Prince-street, Cavendish-square, Middlesex, gentleman; and James Pillans Wilson, of Belmont aforesaid, gentleman, for improvements in treating fatty and oily matters, and in the manufacture of candles and night lights. November 11.

James Pilbrow, of Tottenham, Middlesex, civil engineer, for certain improvements in propelling carriages on railways and common roads, and vessels on rivers and canals. November 13.

Sir George Steuart Mackenzie, of Coul, Ross, Baronet, for an improvement in the manufacture of paper, more particularly for the purposes of writing and copying writings, and machinery for effecting the same; also the manufacture of a fluid or fluids, to be used with the improved paper in the manner of ink. November 15.

William Bedington, junior, of Birmingham, Warwick, manufacturer, for improvements in the construction of furnaces. November 18.

John Dearman Dunnicliff, Nottingham, lace manufacturer, and John Woodhouse Bagley of New Radford, Nottingham, mechanic, for certain improvements in the manufacture of lace and other weavings. November 18.

Felix Moreau, of Ghent, Belgium, engineer, for improvements in the manufacture of corks, and other similar articles made of cork-wood or other materials, and the application of certain of the refuse matters to various useful purposes for which they have never heretofore been employed. Nov. 19.

John Groom, of Oldham, Lancaster, mechanic, for certain improvements in machinery or apparatus for preparing, slubbing and roving, cotton, wool and other fibrous materials. November 22.

Josias Christopher Gamble, of St. Helen's, Lancaster, manufacturing chemist, for improvement in the manufacture of sulphuric acid. Nov. 19.

William Johnson, of Bury, Lancaster, agent, for improvements in machinery or apparatus for preparing cotton, wool, flax, and other fibrous substances. November 25.

Ebenezer May Dorr, of Ludgate-hill, London, gentleman, for improvements in the manufacture of horse-shoe nails. November 25.

Robert William Sievier, of Henrietta-street, Cavendish-square, Middlesex, gentleman, for certain improvements in looms for weaving, and in the mode or method of producing plain or figured goods or fabrics. November 26.

James Nasmyth, of Patricroft, Lancaster, civil-engineer, for certain improvements in machinery or apparatus for hewing, dressing, splitting, breaking, stamping, crushing, and pressing stone or other materials. November 26.

David Auld, engineer, of Dalmarnock-road, and Andrew Auld, engineer, 78, West-street, Tradestown, both in Glasgow, Lanark, for an improved method or methods of regulating the pressure and generation of steam in steam boilers and generators. November 29.

Charles Waterson, of the firm of MacGuire, Waterson, and Co., of Manchester, Lancaster, soap manufacturers, for certain improvements in the manufacture of soap. December 9.

Louis Joseph Wallerand, of Basing-lane, London, merchant, for improvements in dyeing or staining various kinds of fabrics. (Being a communication from abroad.) December 16.

Alexander Turnbull, 48, Russell-square, Middlesex, doctor of medicine, for a new mode or method of more expeditiously and effectually tanning hides and skins, and of extracting and separating the catechnic acid from the tannin acid, in the catechu or terra japonica used in tanning. December 18.

Henry Cartwright, of the Dean, near Broseley, Salop, farmer, for certain improvements in the construction of paddle-wheels. December 20.

NOTES AND NOTICES.

Injury from Smoke.—The Rev. J. Clay, in his report on the sanatory condition of Preston, says that there are only two instances in which the smoke generated in the factories in that town is consumed; and he calculates that if the proprietors of all the factories in the town were to adopt the practice of consuming their smoke, a saving in the washing of clothing would take place at the rate of 1*d*. per head per week, which would amount to 208*l*. 17*s*. per week, or 10,450*l*. 4*s*. per year. But the saving in the borough of Leeds, reckoning it at only a halfpenny per head upon the population, would amount to 312*l*. 10*s*. per week, and 16,250*l*. per year, or a sum nearly equal to that now paid annually for borough rates.

Electricity of the Earth.—MM. Linare and Palmeri have succeeded in obtaining an electrical current from the earth, sufficient to give a shock, decompose water, and to afford a spark. Their apparatus consists of hollow cylinders of iron, covered with seven superimposed coils of copper wire. These cylinders are rapidly rotated by means of wheel works, and the spark is produced by breaking contact with mercury, as in Mr. Clark's electro-magnetic machine. The maximum of electric force is attained whenever the revolving system of cylinders arrives in the position of the dipping needle. The rotation should take place round a line perpendicular to the plane of the magnetic meridian.

New Threshing Machine.—There is now in operation at Tywarnhayle experimental farm, belonging to S. and R. Davey, Esqrs., a threshing machine, which, from its simplicity of construction, and its great power, is a vast improvement on the former threshing machines or those now generally used. It performs the work of three horses, and threshes 125 sheaves of wheat and 225 sheaves of barley or oats an hour; and this is performed by a poor pony of 13 hands high. The improver is a miner named Michael Harris, a poor man residing at Silverwell, in the parish of St. Agnes, who is possessed of surprising natural genius, and therefore deserves support. He carries the whole apparatus about in a small cart, and contracts with the farmers of the neighbourhood at per 100 sheaves. Several gentlemen have seen the machine and pronounced it to be the greatest improvement yet made.—*West of England Conservative.*

Mammoth Steam Electrical Machine.—A hydro-electrical machine, of extraordinary and unprecedented power is now being constructed for the United States. It will be able to produce a spark of 36 inches, to coat 3,500 feet of metallic surface, in a battery of 48 Leyden jars, of 2 feet high by 10 inches in diameter. This shock would kill a thousand men in an instant, if it were passed through such a chain! This machine will be more than four times as powerful as the one exhibited at the Polytechnic Institution, London, whose effects have been witnessed by more than three hundred thousand persons within the last year, and is now by far the most powerful instrument in the world. The expense will be nearly 4,500 dollars, with the apparatus for illustration. The name of this leviathan machine is to be the "Benjamin Franklin;" and as it will not be shown at all in Europe, America will possess, exclusively, this magnificent, unequalled instrument. It will leave the manufactory for the United States early in the year.—M. L.

Waterspout in Mexico.—At Yabu, in the late hurricane, a tremendous waterspout passed through the place, doing much damage. It was about 20 feet wide. In its course it passed over two houses, driving the roofs through, and entirely destroying one. Five children were killed in one of the buildings. The effect was the same as if a violent river had run through the town. Trees, grass, and everything that came in its way were torn up.—Mechanics and artisans were very scarce, and were receiving from four to five dollars a day.—*American Paper.*

Statistics of Earthquakes.—The *Courier Français* states, that since the sixteenth century 161 earthquakes have been experienced in the West Indies, viz.:—in the 16th century 1; 17th, 9; 18th, 43; 19th 108; of which 12 were in January, 9 in February, 11 in March, 11 in April, 10 in May, 10 in June, 7 in July, 15 in August, 17 in September, 25 in October, 14 in November, and 10 in December; 32 in winter, 31 in spring, 39 in summer, and 41 in autumn.

END OF VOLUME FORTY-ONE.

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